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ECONOMICS OF REPLACING CLING PEACH TREES

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CALIFORNIA AGRICULTURAL EXPERIMENT STATION
GIANNINI FOUNDATION OF AGRICULTURAL ECONOMICS

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ECONOMICS OF REPLACING CLING PEACH TREES

J. Edwin Faris[1]

I. INTRODUCTION

The Problem

A large number of cling peach producers in California have one or more blocks of trees that have passed the years of peak production. These orchardists are presently confronted with the basic decision of determining the age at which they should replace these trees to attempt to maximize net revenue over time. Some cling peach producers replace their trees before they are 20 years old while others, apparently facing similar physical and economic conditions, do not replace their trees until they are 30 or more years old. This difference in the replacement age undoubtedly results in a considerable difference in net revenue to the orchardists over time. Any information that will permit the orchardists to make a better decision with respect to replacement practices will be of considerable value.

Objectives

The major objectives of this investigation are:

1. To obtain estimates of actual and anticipated yields of cling peach trees over their economic life span.
2. To determine the cost of producing cling peaches for a representative sized orchard.
3. To determine the optimum time to replace cling peach trees under varying yield, price and cost conditions.

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Methodology

In the determination of the appropriate time to replace their trees, orchardists are confronted with a different, and perhaps more difficult, type of management problem or decision than are many of the other individuals engaged in farming. These difficulties stem from the length of the production process, variations in yields over the productive life of the trees, the large initial investment in planting and the lapse in time between the planting date and the time when gross revenue from the orchard becomes greater than costs of production. A decision must be made each year as to whether or not a particular tree or block of trees should be replaced. In order to make this decision the net revenues from the present trees must be compared with the net revenues that would be forthcoming from the replanted trees or orchard. Thus it is necessary to determine the annual net revenue and the stream of net revenue from the trees. This will be a function of the expected yields, prices and costs.

Although there has been a considerable amount of literature written concerning the replacement of assets (e.g., trees) none of the methodology set forth appeared to be conceptually adequate for determining the optimum replacement time or pattern for cling peaches.1/ Therefore it was necessary

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1/ For example see: Lutz, Friedrick A. and Vera, The Theory of Investment of the Firm, Princeton University Press, Princeton, N. J., 1951; Allen, R. G. D., Mathematical Analysis for Economist, Macmillan and Co., Ltd., London, 1938; Gaffney, M. Mason, Concepts of Financial Maturity of Timber and Other Assets, A.E. Information Series No. 62, Dept. of Agricultural Economics, North Carolina State College, Raleigh, September 1957; Hildreth, Clifford G., "Note on Maximization Criteria," Quarterly Journal of Economics, November 1946, pp. 156-164.

to formulate a method or criterion that would permit an optimum replacement age to be determined. The criterion that is used in this investigation defines the optimum replacement pattern as that pattern of replacement that will maximize the flow of expected net revenue over time. More specifically the criterion for replacement states that in order to maximize expected net revenue the present trees should be replaced when their marginal (annual) net revenue becomes less than the largest flow or stream of expected net revenue that could be obtained by replanting. In order to avoid the difficulty of an orchardist being influenced by the limited number of production periods in his life time it is assumed that he can sell the orchard at any time for the present value of the expected stream of net revenue from the orchard.

Procedure

A description of the cling peach industry is basic to an understanding of the scope and the data used in this investigation. Therefore, a brief description of the industry is presented in the second section. The third section briefly reviews the major factors that are expected to affect yields. The sample and questionnaire were not designed to obtain input-output relationships. If this had been one of the objectives the type of data obtained would have been entirely different. Variations in yields by age of tree was the prime consideration. However, because of the large variations in yields for trees of the same age it was necessary to investigate some of the major factors that would be expected to cause this variation. These factors were classified into two categories of inputs, the resource base (soil, climate, tree variety and spacing) and annual inputs. Nothing quantitative can be said about the latter from the information obtained in this investigation. The former were investigated only as a means of aggregating the data. For example, are the yields from different varieties or in different areas quite similar or should they be treated separately? The effect of climate was expected to be a major factor affecting the yields in any one year. To obtain an indication of the importance of this factor the differences between anticipated yields and actual yields were investigated.

A number of yield curves are presented in the fourth section of this paper. These yield curves were fitted free hand from the observations of actual yields and anticipated yields. Because of the large variation in yields for trees of the same age, yields were classified as above average (very good) and below average (poor) as well as the average for all trees of the same age. This information was used to construct the synthesized yield curves. These synthesized yield curves are the basis for the rest of the analysis as they represent the actual or anticipated yields that orchardists believe they will obtain from various blocks of cling peaches over the life of the trees. In the fifth section costs are applied to these yield curves. The fixed costs are based upon a 40 acre orchard. Most of the other costs vary by age or yield of tree.

The analytical techniques for determining the optimum replacement age of cling peach trees are set-forth in the sixth section. The information from the three preceding sections are used to obtain the optimum replacement patterns presented in the seventh section. The effects of changes in prices, costs and yields are also investigated in this section.

II. THE CLING PEACH PRODUCING INDUSTRY IN CALIFORNIA

California is the only State in the United States that produces a significant tonnage of clingstone peaches on a commercial basis. Consequently a consideration of the cling peach industry in California is in essence a consideration of the cling peach industry in the United States.

Description of the Industry[1/]

In 1958 only three other fruits had larger acreages of land devoted to their production in California than did cling peaches. These fruits are grapes, oranges and prunes. The acreage of lemons is slightly less than the acreage of cling peaches.

Acreage

Since 1946 there has been approximately 46,000 acres of bearing cling peach trees in California. The acreage of nonbearing cling peaches fluctuated around 10,000 acres between 1946 and 1953. However, the non-bearing acreage has increased steadily since 1954 to approximately 26,000 acres of nonbearing trees in 1958. Although the magnitude of the increase in bearing acreage is difficult to ascertain because of the lack of information on the number of trees being replaced, it is very probable that there will be a substantial increase in bearing acreage in the next few years.

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1/ Most of the information in this section is based upon various publications by the California Crop and Livestock Reporting Service titled "Acreage Estimates California Fruit and Nut Crops - - - -," Sacramento, California.

Areas of Production

There are two major cling peach producing areas and two minor cling peach producing areas in California (Figure 1). One major producing area is located in Sutter, Yuba and Butte counties with a major part of the acreage in Sutter County. This will be referred to as the Yuba City area. The other major producing area is located in Stanislaus and Merced counties with the largest concentration of cling peaches in Stanislaus County. This will be referred to as the Modesto area. An important, although a minor, producing area is located around Linden in San Joaquin County. The other minor producing area is in Fresno, Kings and Tulare counties with most of the peaches in this area being produced in the latter county. This will be referred to as the Visalia area. These four areas account for approximately 95 per cent of the cling peaches produced in California.

Varieties

There are over 60 different varieties of cling peaches produced commercially in California. However, only 15 of these varieties are planted on more than 1,000 acres. The acreage planted to these 15 varieties constitutes more than 80 percent of the total cling peach acreage. Varieties are classified as to their relative harvesting dates. These are extra early, early, late and extra late. Approximately 75 per cent of the cling peaches are classified as early varieties or late varieties with the latter having the largest acreage.

Age of Trees

In 1958 approximately 21,000 acres were 14 or more years of age. This represents 29 per cent of the total acreage and 45 per cent of the bearing acreage. Similarly 13 per cent of the total acreage was 19 or more years old. This represented 20 per cent of the bearing acreage in 1958. It is estimated that approximately 5 per cent of the total acreage or 8 per cent of the bearing trees are 22 or more years old. Although it is difficult to generalize from the available data it appears from the above that a large percentage of the cling peach producers replace their trees when the trees are between the age of 19 and 21 years old.

Marketing Order

The California Marketing Act of 1937 permits crop curtailment programs to be put into effect.[1/] Control programs have been in effect for cling peaches since 1937 with the exception of 1938 and the war years 1943-1945. A direct control on the quantity produced has been put into effect in 4 years. The method used is that of a green-drop where a certain percentage of the cling peach crop is eliminated by the orchardist when the peaches are still immature. In 1950 and 1952 there was a green-drop of 15 per cent of the total crop. In 1954 the green-drop amounted to 17 per cent. In 1957 a 16 per cent reduction in the tonnage of cling peaches was accomplished either by a green-drop or by removal of trees in lieu of green-drop. Although the effect of the marketing order will not be considered in this investigation it is possible that it has an effect upon the optimum replacement pattern for a number of orchardists. This is because the marketing order influences both yields and prices. In addition trees may be removed somewhat earlier than usual if trees may be removed in lieu of green-drop.

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1/ For a discussion of marketing orders, see: Hoos, Sidney, Economic Objectives and Operations of California Agricultural Marketing Orders, Calif. Agr. Exp. Sta., Giannini Foundation of Agricultural Economics, Mimeo. Report No. 196, May 1957. For the details of the cling peach program see: Hoos, Sidney, California Agricultural Marketing Programs, Handbook of Commodity Specifications, Calif. Agr. Expt. Sta., Giannini Foundation of Agricultural Economics, Mimeo. Report No. 200, October 1957, p. 49.

III. FACTORS AFFECTING YIELDS

The optimum or "best" age to replace cling peach trees is dependent upon the stream of net revenue from blocks of trees over time.1/ The first step in the determination of the optimum time to replace trees is the specification of the physical inputs required to produce a given output. This is somewhat difficult because the output in one year is dependent upon the inputs in the previous years as well as the inputs in the year under consideration.

The physical input-output relationships on the production function for cling peaches are not determined by the age of the tree alone. The most important factors influencing the production surface (expressed in terms of yield) are believed to be age and variety of tree, climate, soil, spacing of trees, fertilizer, water, cultivation practices, thinning, pruning and disease and pest control. Mathematically this might be expressed as,

$$Y = f(a, v, c, s, st, f, w, cp, t, p, d)$$

where Y is the yield of cling peaches, a is the age, v is the variety, etc.

There are two basically different types of factors included in the above function. One type might be classified as the resource base. This includes age, variety, climate, soil and spacing of trees.2/ The other type can be classified as annual inputs and includes fertilizer, water, cultivation practices, thinning, pruning and disease and pest control.

1/ Throughout this paper it is assumed that the orchardists will replant cling peaches rather than other fruits, nuts or row crops.

2/ The climatic factor is somewhat different than the other factors in that it is unpredictable and varies from year to year.

Logically yields from the blocks with 108 trees per acre should be higher than yields from blocks with 90 or 100 trees per acre in the earlier years before the trees have reached maturity and start to compete for space. From the available information this does not appear to be substantiated. Therefore, the information does not appear to justify assuming a difference in yields between the blocks of cling peaches on the basis of the number of trees per acre. In the further analysis it will be assumed that there are 100 trees per acre which is approximately the average of all trees planted.

Variety of Tree

There were not a sufficient number of observations from the sample to test the hypothesis that there are differences in yields among individual varieties.

Population estimates.--To obtain additional information on yields by variety the population estimates of cling peach yields published by the Cling Peach Advisory Board were used.1/ These population estimates lump all of the extra early maturing varieties into one group, the early maturing varieties into another, the late maturing varieties into a third group and the extra late varieties into a fourth group.2/ Therefore, the yields from extra early maturing varieties will be compared with yields from early maturing varieties, etc. Yields by maturity date and age were tabulated for the 1953

1/ Orchard and Production Survey, Annual Issues 1953-54 to 1956-57; Cling Peach Advisory Board, San Francisco, California.

2/ The maturity date has reference to the time of harvest within a season, not the time required before the trees begin to bear fruit.

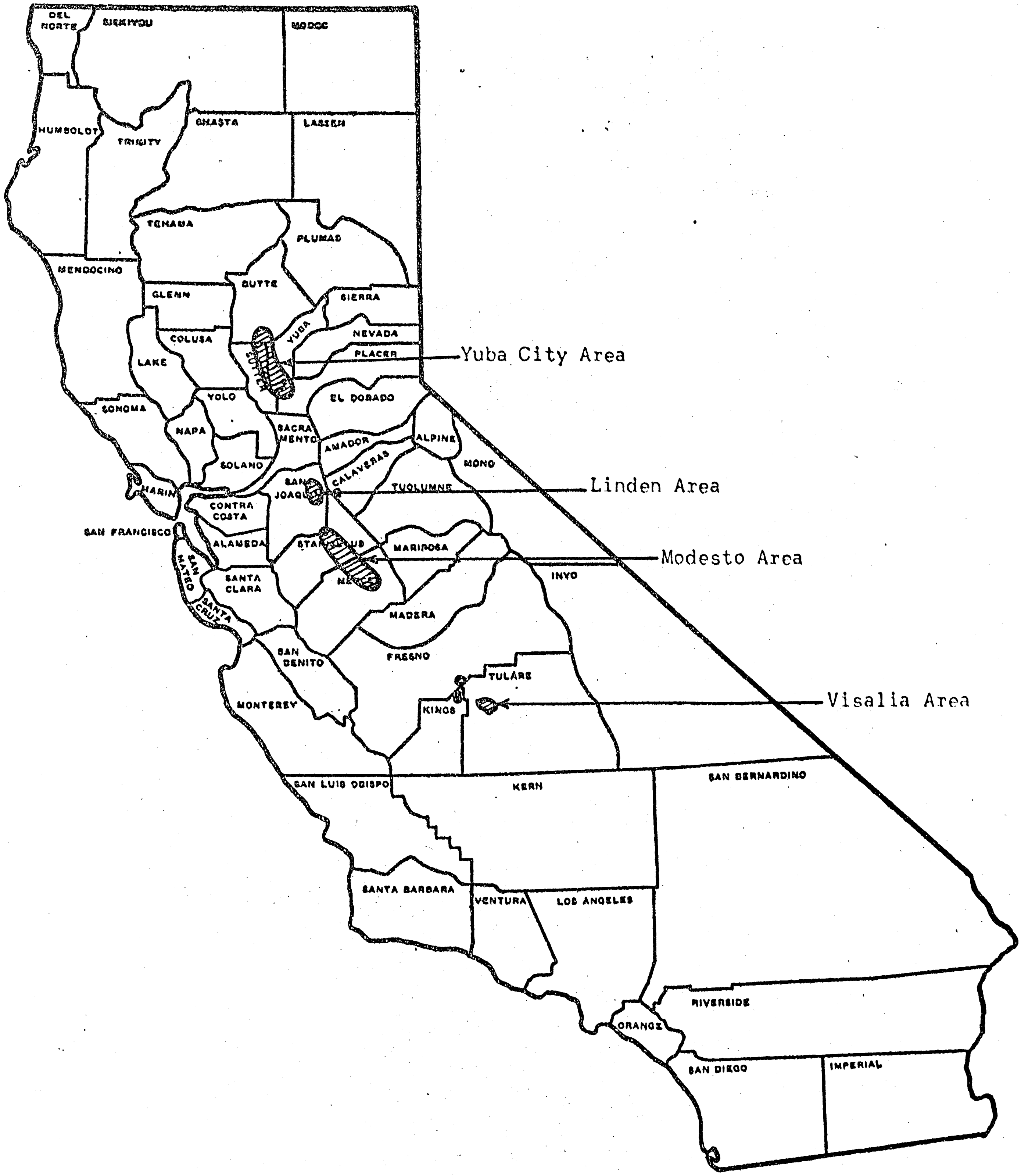

Figure 1. The Four Largest Cling Peach Producing Areas in California

Source: Rock, Robert C. and A. D. Rizzi, The Where and When of California Fruit and Nut Crops, Manual 20, California Agricultural Experiment Station, Berkeley, December 1955.

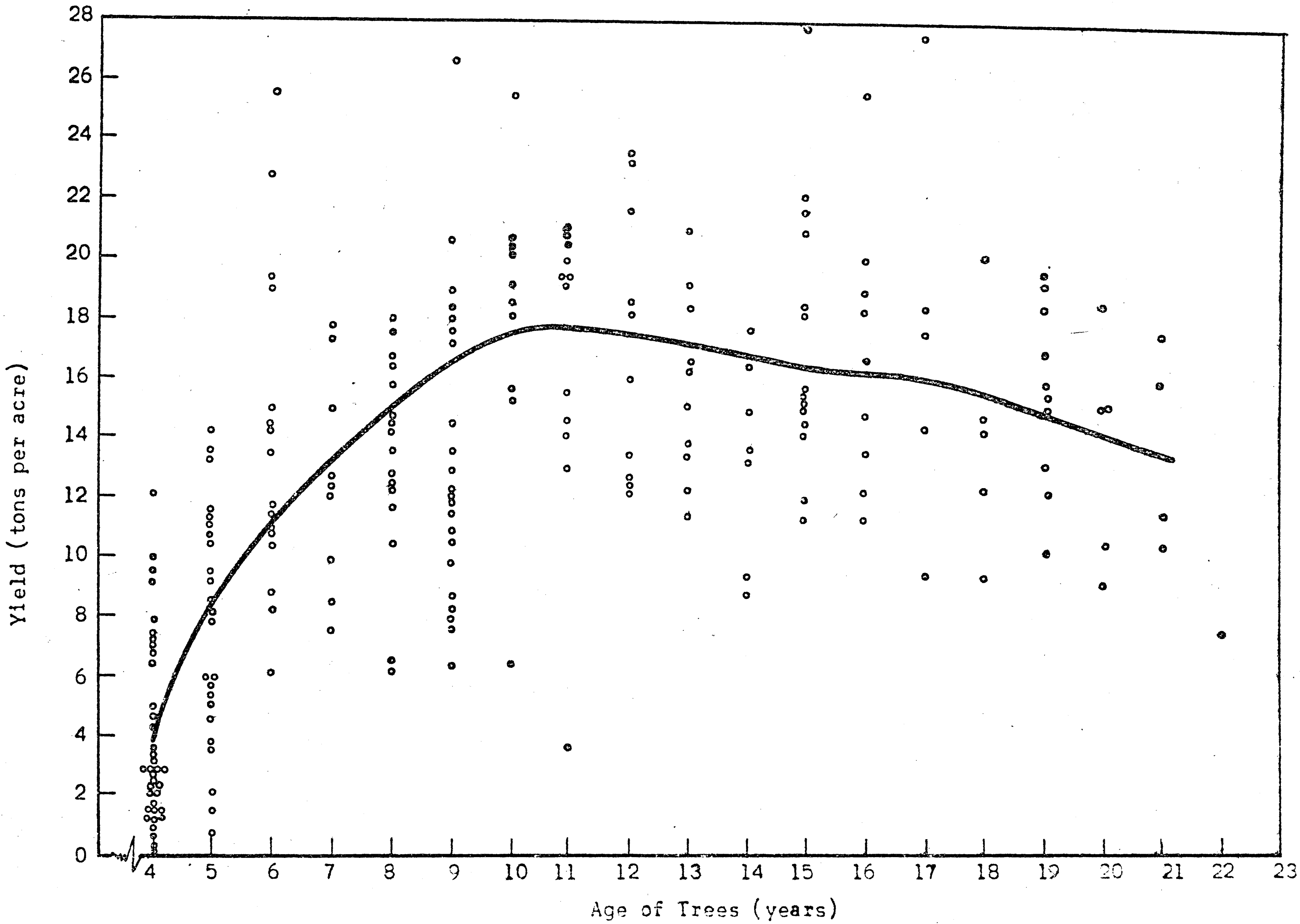

Figure 2. Yield Curve Fitted to Actual Yields for the 1956 Crop Year, Extra Early and Early Varieties, Yuba City and Modesto Areas

soils. As most orchardists are not able to furnish information on soil types an attempt was made to obtain this information from soils maps. Unfortunately, the available soils maps for most of the cling peach producing areas are not sufficiently detailed to precisely locate the soil boundary lines for each orchard, let alone the blocks of peaches within an orchard. An attempt to use this limited soils information did not result in any meaningful indication of the effects of soil on production.1/ Therefore, from the available information it is not possible to quantify the effects of soil on yields.

Spacing of Trees

Most of the cling peach trees are planted so that there are 90, 100 or 108 trees per acre. However, there are 20 per cent more trees per acre when 108 trees rather than 90 trees per acre are planted. Does this difference in the number of trees per acre have an effect upon yields over time? In order to investigate this question, yields from orchards in the survey were tabulated by the spacing of the trees and plotted on a graph for the Yuba City and Modesto areas (Figure 2). Yields from the blocks of peaches with 108 trees per acre were higher than yields from blocks with 96 to 100 trees per acre in 12 out of the first 20 years and were higher than the blocks with 90 trees per acre in 13 out of the 20 years. It is in the 13th through the 17th year when the yields from the blocks with 108 trees per acre are clearly higher than the blocks with fewer trees per acre.

1/ Orchards were classified by soil grade using the Storie Index of soil productivity. Yields were compared among soil grades. However, most of the orchards fell into the soil grade with the highest productivity capacity and the few observations in the other soil grades made it impossible to make a meaningful analysis.

In addition to the sample mentioned above 16 detailed schedules were obtained on the physical and monetary inputs and timing for all of the operations required to produce cling peaches.[1/]

Publications, primarily California Experiment Station publications, were also used as a source of information. However, these publications were mainly used as a check on the validity of the data obtained from the survey.

Resource Base

The major factors making up the resource base that are expected to have an effect upon yields include soil, climate and trees. With respect to trees the age, variety and spacing will be investigated. It is known that the age of the tree has a significant effect upon yields. The exact magnitude of this effect will not be fully investigated at this point in the analysis. However, each of the other major components of the resource base will be discussed in terms of their effect on yields for different ages of trees.

Soil

Cling peach trees require a rather deep, well drained and fertile soil for best production. Trees planted in the best soils would be expected to produce substantially higher yields than trees planted on marginal orchard

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1/ After the physical data from all of the schedules were compiled and summarized the results were checked by a group of cling peach producers in the Yuba City area at a meeting conducted in cooperation with the farm advisor. In addition several orchardists were contacted individually to check the physical inputs. Appropriate changes were then made in the original data.

It would be very useful and constructive to derive mathematical production function of the type specified above, for cling peaches over time. However, the information necessary to permit an adequate statistical analysis of the effects on yield over time of several different levels of an input, e.g., fertilizer is beyond the scope of this investigation. To do this, information concerning the input-output responses would need to be obtained for the same or similar trees over a number of years. Therefore, no attempt was made to obtain primary data in a form that would permit such an analysis. Unfortunately the secondary data available are also lacking in this respect. Information on the resource base was obtained as a basis for aggregating the data.

Sources of Data[1]

The primary source of information for this study was from a survey of approximately 200 cling peach producers in California conducted in the winter of 1957. More than 800 blocks of peaches were included in the sample.[2] Although this might appear to be a large number of observations it would require 1,500 blocks of trees to have 1 observation for each of the 15 major varieties for a 25 year period in each of the 4 producing areas. The information obtained was primarily concerned with actual and anticipated yields by blocks although information was also obtained on tree spacing and the quantities used of some of the major inputs.

1/ A more detailed discussion of the survey of cling peach producers and the reliability of the sample is presented in Appendix A.

2/ Different varieties of trees or trees of the same variety but different ages or trees of the same variety and age but located in different areas of an orchard are considered as being different blocks of peach trees.

through the 1956 crop years and for the average of the 4 years (Table 1). Without exception the yields from the late maturing varieties are higher than yields from the early maturing varieties. The yields from extra early and extra late maturing varieties are quite similar to those for early and late maturing varieties, respectively. Because of the relatively small acreage of these varieties, especially in the older age groups, and because of the similarity in yields between the extra early and early varieties and between the extra late and late varieties it was decided to classify varieties by yields into only 2 groups. Throughout the remainder of this investigation the extra early and early maturing varieties will be referred to in the text as the early maturing varieties and the late and extra late maturing varieties will be referred to as the late maturing varieties.

Sample estimates.--Individual observations from blocks of peaches in the Yuba City and Modesto areas were plotted for the early maturing varieties (Figure 3) and for the late maturing varieties (Figure 4).1/ The large variation in yields for trees of the same age is very evident. A yield curve in both of the figures was fitted free hand for the early maturing and the late maturing varieties.2/ Approximately 1/3 of the observations fall

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1/ The reason for plotting yields for only the Yuba City and Modesto areas will be explained in the section on climate.

2/ These estimated yield curves could have been fitted mathematically. However, for the purpose that they will be used for in this analysis a free hand curve, fitted to the average yields for each year, is very satisfactory and much less time consuming. These free hand curves will be "smoothed out" later in the analysis.

TABLE 1

Yields of Cling Peaches by Maturity Date and Age, California, 1953-1956, Tons Per Acre

Maturity date and year	Age of trees				
	5 years	6 years	7-16 years	17-21 years	22 years and over
	tons per acre				
Extra Early					
1953	5.56	7.60	11.74	7.02	a/
1954 b/	7.37	7.06	10.70	6.09	a/
1955	4.66	10.24	11.99	9.10	a/
1956	7.51	10.00	15.19	13.07	a/
Ave. 1953-56	6.28	8.72	12.40	8.82	--
Earlies					
1953	4.45	7.72	12.88	12.75	10.67
1954 b/	5.05	8.11	10.15	9.95	9.54
1955	4.82	8.64	11.50	10.73	10.47
1956	6.25	10.67	14.10	13.18	11.61
Ave. 1953-56	5.14	8.78	12.16	11.65	10.51
Lates					
1953	6.34	10.44	14.18	14.18	11.52
1954 b/	6.31	9.42	11.41	11.65	10.20
1955	6.08	9.89	13.11	13.31	12.24
1956	8.07	13.51	15.99	14.41	13.33
Ave. 1953-56	6.70	10.82	13.67	13.39	11.82
Extra Late					
1953	5.62	6.77	11.73	12.83	10.07
1954 b/	5.84	10.17	10.97	9.90	7.54
1955	6.05	9.07	13.87	13.63	9.42
1956	6.62	14.67	15.87	14.03	9.67
Ave. 1953-56	6.03	10.17	13.11	12.60	9.18
All Varieties					
1953	5.33	8.17	13.17	13.67	10.73
1954 b/	5.91	8.84	10.86	11.09	9.43
1955	5.48	9.35	12.59	12.60	11.19
1956	7.10	12.36	15.23	14.05	12.42
Ave. 1953-56	5.96	9.68	12.96	12.85	10.94

a/ Less than 35 acres of peaches.

b/ Seventeen per cent of the total crop was eliminated by a green-drop in 1954.

Source: Orchard and Production Survey, Annual Issues 1953-54 to 1956-57; Cling Peach Advisory Board, San Francisco, California.

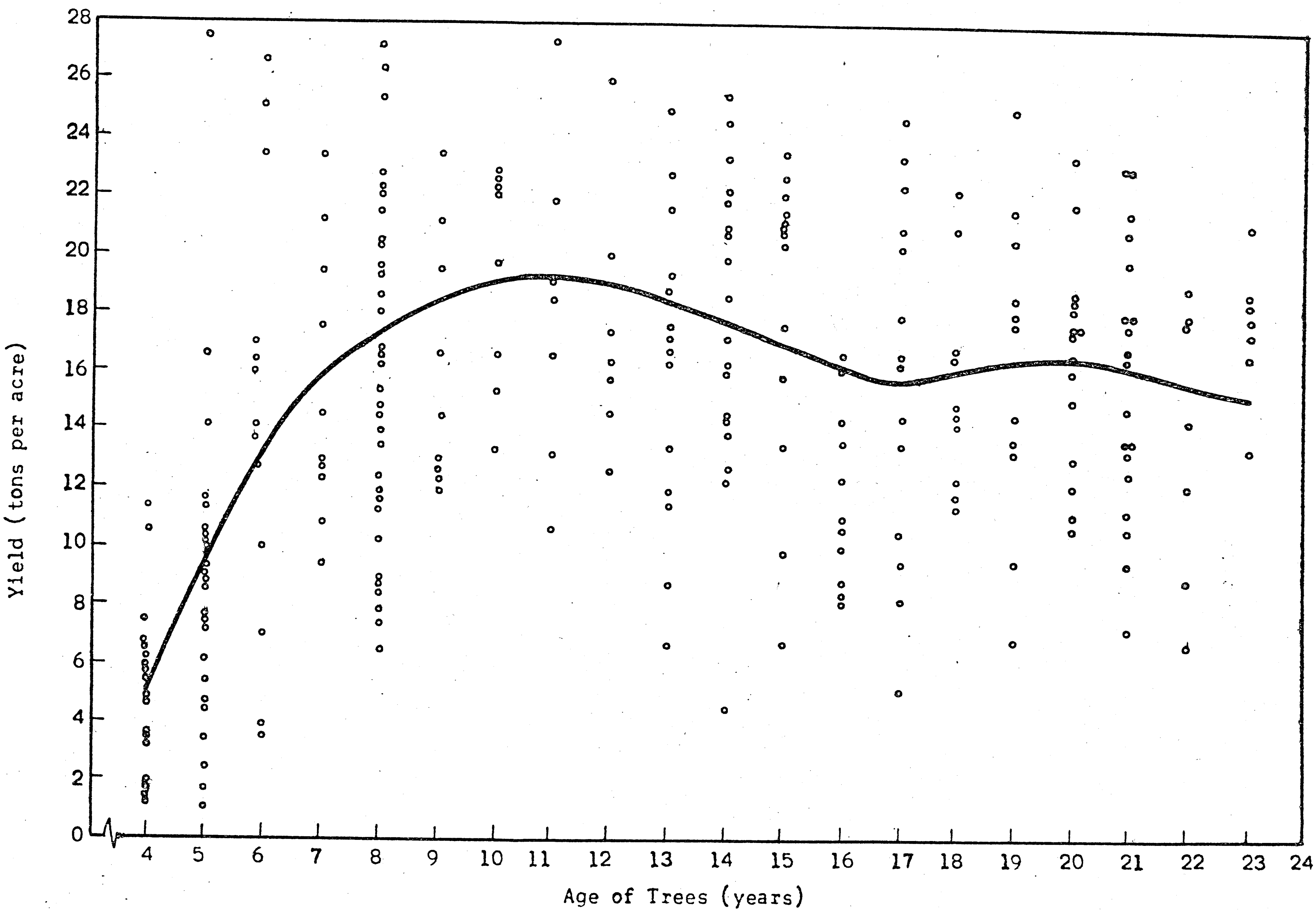


Figure 3. Yield Curve Fitted to Actual Yields for the 1956 Crop Year, Late and Extra Late Varieties, Yuba City and Modesto Areas. a/

a/ Seven observations were above 28 tons per acre and are not shown in this figure.

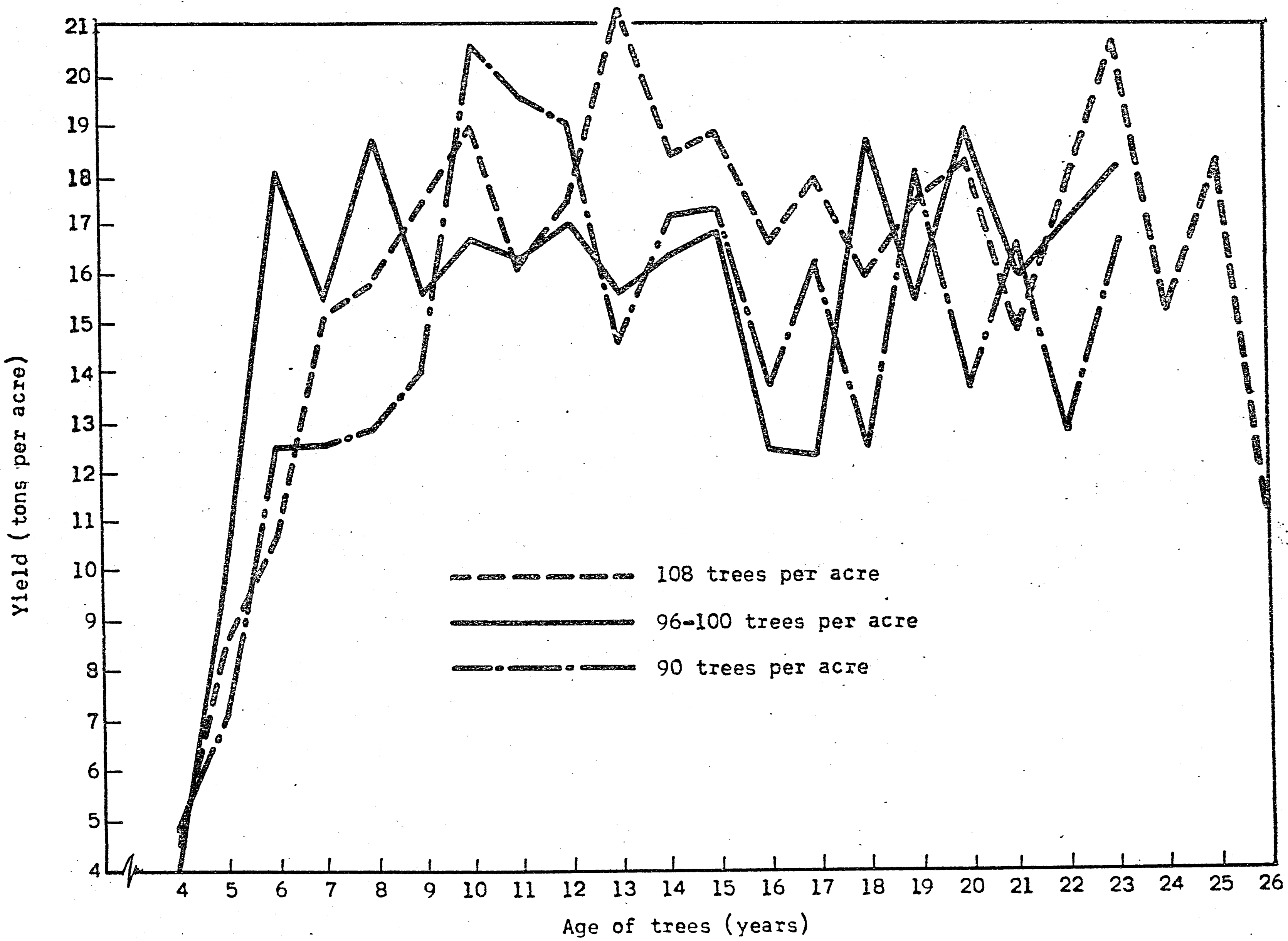


Figure 4. Yields in 1956 by Spacing of Trees, Yuba City and Modesto Areas, California.

within plus or minus 2 tons of the yield curves. This means that 2/3 of the observations lie outside of this 4 ton "band" or "strip." Plus or minus 3 tons from the yield curves include 55 per cent of the observations for the early maturing varieties and only 43 per cent of the observations for the late maturing varieties. The increase in yields shown for older trees is a result of cross sectional data. Some of the lower producing trees have been pulled which gives an upward bias to the curves beyond 17 or 18 years.

Climate

The largest part of the year to year fluctuations in yields is due to climatic factors. Some orchards are more subject to adverse weather conditions than others because of location. These are more or less due to the localized conditions that affect yields. Undoubtedly a large part of the variation in yields shown in Figures 3 and 4 can be attributed to local weather conditions. However, in addition to the local conditions there may be differences in yields between areas within a year or over a number of years. This will be investigated in the following section.

Differences in yields among areas.--The differences in yields, if any, among the 4 largest cling peach producing areas would indicate the effect of climatic conditions among areas providing the assumption that all other physical inputs in each area were identical is valid. Although the validity of this assumption can be questioned it should be sufficiently valid to be useful in investigating the effect of climate on yields among areas. Therefore, population yields were tabulated by age of tree, maturity date and area of production (see Appendix A, Tables 2 and 3). Yields in the two major producing areas, the Yuba City and the Modesto areas, are quite similar for trees of the same age and maturity date although the year to year variations are quite large. In order to determine if these two areas logically might be combined an analysis of variance was calculated from the sample data for the 1956 and 1955 crop years.[1/] In both years the difference in yields between areas was highly significant. However, in 1956 the yields in Yuba City were higher than those in the Modesto area but in 1955 the yields in the Modesto area were higher. Thus the analysis indicates that the year to year variation in yields between areas is high but does not reject the hypothesis that yields in the two areas can logically be combined to obtain estimate yields.

Yields in the Linden area are considerably lower than in the Modesto and Yuba City areas and the yields in the Visalia area are a little lower than those in the major producing areas. Actually the Visalia area should be divided into 2 areas. Yields in the northern part of this area (around Kingsburg) are as high as the yields in the two major producing areas while yields in the southern part (around Visalia and Exeter) are considerably lower. Because of this difference and because of the relatively few number of observations obtained in the Linden and Visalia areas the remainder of the analysis will be based on the observations from the Yuba City and Modesto areas only.

1/ In the survey of orchardists information was also obtained on yields in the 1953 through the 1956 crop years. However, the number of responses on yields for these earlier years decreased as the length of time increased.

Annual Inputs

The annual inputs that are expected to have an effect upon the level of the yields include fertilizer, water, cultivation practices, thinning, pruning and disease and pest control. As was mentioned previously no attempt was made to gather primary data in order to quantify the effects of these inputs on yields. However, information was obtained in the questionnaire with respect to the quantity and/or type of each input used.

Fertilizer and Water

The quantity of fertilizer and water applied in 1956 was readily obtained. The quantity of water applied per irrigation was rather standard for most of the cling peach orchards. However, the quantity of fertilizer applied varied from zero pounds per acre to more than 280 pounds of nitrogen per acre. The residual effect of fertilizer applied in previous years and the effect of nitrogen from green cover crops must also be considered in evaluating the input-output relationships between fertilizer and yields. As this information is not available the typical or modal applications of fertilizer, as well as water, will be used in this investigation.

Cultivation Practices

Cultivation practices as used here is concerned primarily with subsoiling and cover crops. Subsoiling and cover crops are used to increase the penetration of water into the soil. From 1951 to 1956 approximately 60 per cent of the blocks of cling peaches were subsoiled one or more times. In this same time period slightly less than one-half of the blocks of peaches had cover crops planted on them one or more times. This is a good indication that adequate water penetration is a problem in many of the orchards. Because subsoiling is believed by many to be harmful to the root system and because it is usually not done annually, it will be assumed in this investigation that cover crops are planted annually to increase water penetration or to prevent a decline in the water penetration.

Thinning and Pruning

Questions were asked in the questionnaire regarding thinning and pruning practices. The answers were difficult to classify let alone quantify. The usual answer to the question on pruning was "medium." The answers with regard to thinning were somewhat better. Approximately 32 per cent attempted to leave a certain number of peaches per tree. The most common answers were 1,000 to 1,100 and 1,200 to 1,500 peaches per tree. These answers, however, were not very well related to the age of the trees in many instances. Another 28 per cent said that they attempted to space the peaches so that there would be a peach every so many inches, e.g., every 6 inches. The other 40 per cent said that they thinned by "what the tree will bear." Although it is evident that thinning and pruning practices have an influence upon yields it would require a special and controlled study to isolate these influences.

Disease and Pest Control

The qualitative effect in terms of the timing and the content of sprays is as important as the number of sprays. Failure to apply a certain spray at the correct time or inadequate coverage of a spray may result in a tremendous reduction in yields of marketable cling peaches. Information on the lack of control was used in this investigation to delete several of the unusually low yields from the analysis.

IV. THE CONSTRUCTION OF YIELD CURVES

A number of yield curves will need to be constructed to take into account the numerous possibilities that exist. An attempt will be made to construct a number of yield curves sufficiently large to be useful to most of the cling peach orchardists in California. Data were obtained on the farmers' anticipated yields in 1956, actual yields in 1953 through 1956 and farmers' estimates of what constituted a very good and a poor yield in order to construct yield curves.

Anticipated Yields

The farmers were asked if the 1956 yields were above or below their anticipations at the beginning of the crop year and if so by how much. The response did not appear to be satisfactory in that a large number of orchardists said that the 1956 yield was what they had anticipated earlier even though they had relatively high or low yields. Undoubtedly, in order to obtain an unbiased answer to this type of question it would have to be asked at the beginning of the crop year rather than after the crop has been harvested. However, the questionnaire contained another question that attempted to circumvent this problem of bias. This question was "What yield, for trees of the same age (and condition) as yours, would you consider an average yield?" It appears to the author that these estimates are a fairly adequate measure of the farmers anticipated yields at the beginning of the crop year. Consequently, these estimates will be referred to as anticipated average yields throughout the remainder of the analysis.

The individual observations of anticipated average yields were plotted for early maturing and late maturing varieties and a free hand curve was fitted (Figures 5 and 6, respectively). Several points of special interest are of note in these diagrams. The curves fitted to the anticipated yield curves are somewhat lower than the curves fitted to the actual yields in 1956 (see Figures 3 and 4). The most striking difference, however, is the flatness of the curves for anticipated average yields between the 10th and the 15th year as compared with the peak reached in the 11th year for the actual yields in 1956.

The variation in anticipated yields is not nearly as great as the variation in actual yields. Plus and minus 2 tons from the estimated yield curve for anticipated yields includes 61 per cent of the observations and plus or minus 3 tons includes more than 70 per cent of the observations.

Average Yields 1953 Through 1956

Actual yields were obtained from the orchardists, whenever possible, for the 3 years prior to 1956. Although the response was somewhat limited the average yield was tabulated for the 4-year period 1953 through 1956 by age of tree and maturity date. The average yields 1953-1956, are very similar to the anticipated average yields (Figure 7). Thus it appears that the 1956 yields were somewhat unusual in that the yields for trees 10 to 15 years of age were considerably higher than the 4 year average and the anticipated average yields. This difference in yields is difficult to explain. It is probably due to unusually good climatic conditions in 1956, increased productivity per acre and sampling error. The importance of each of these factors, however, can not be ascertained from the available data.

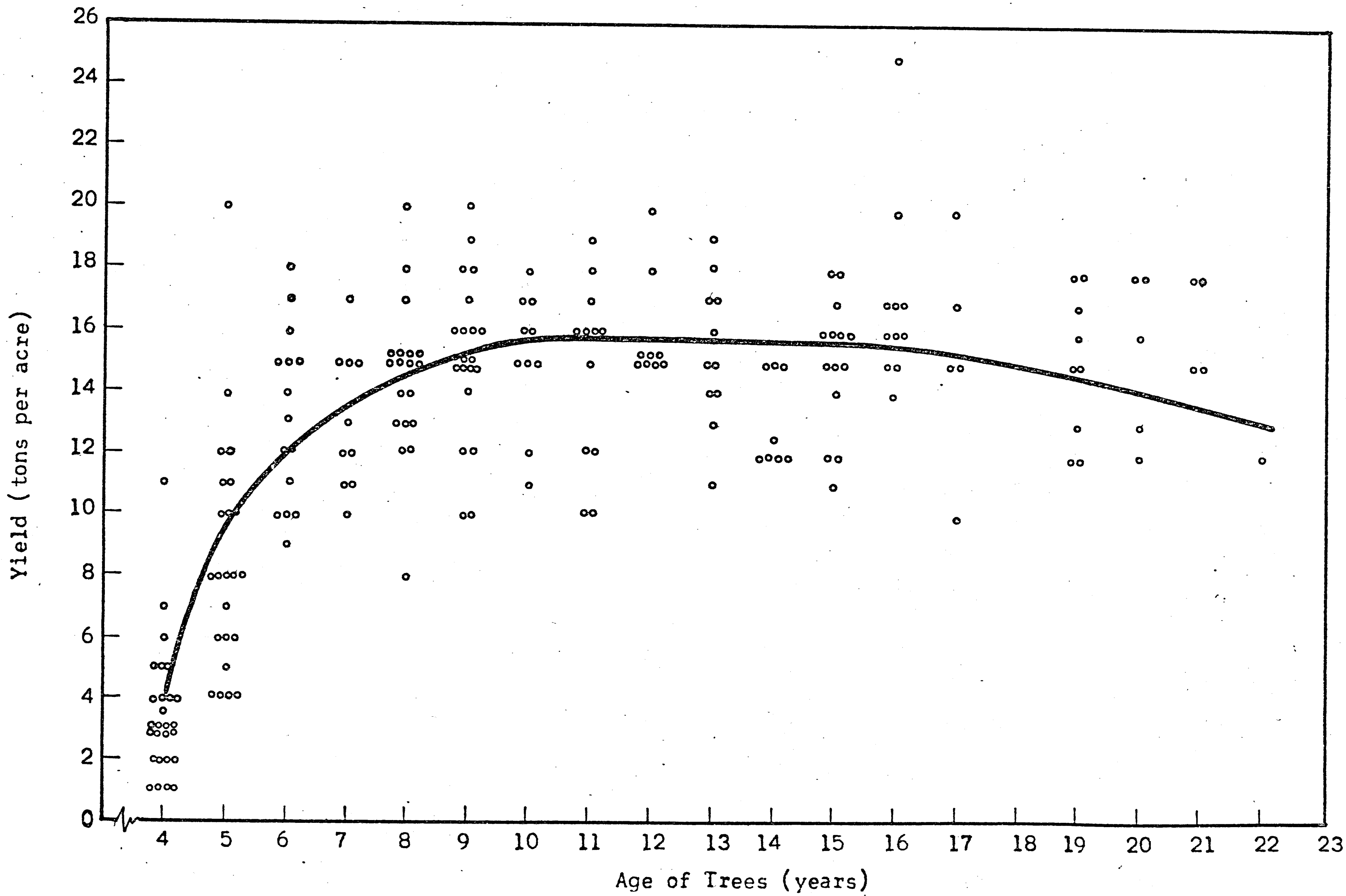


Figure 5. Yield Curve Fitted to Anticipated Average Yields for the 1956 Crop Year, Early Maturing Varieties, Yuba City and Modesto Areas

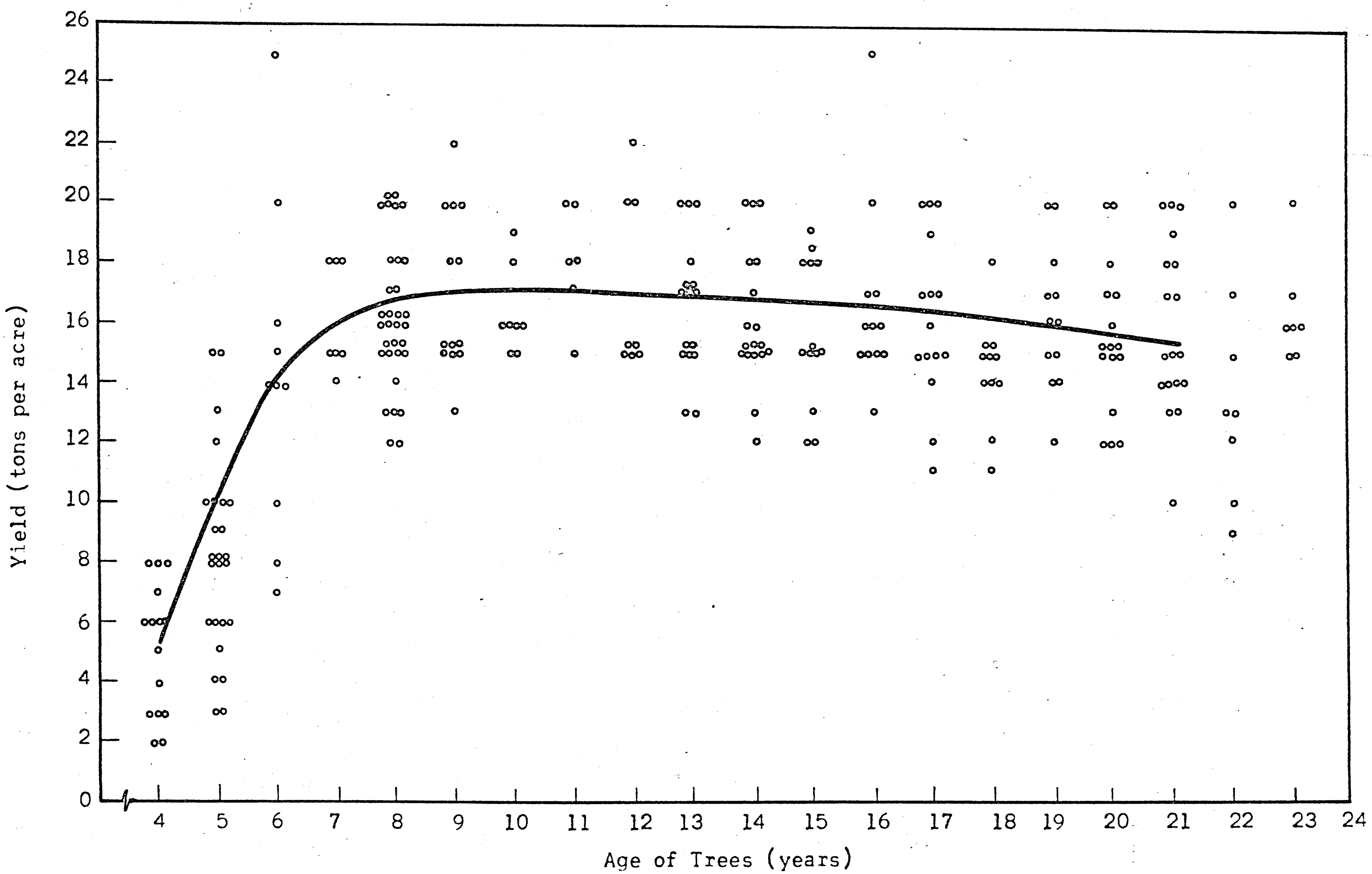
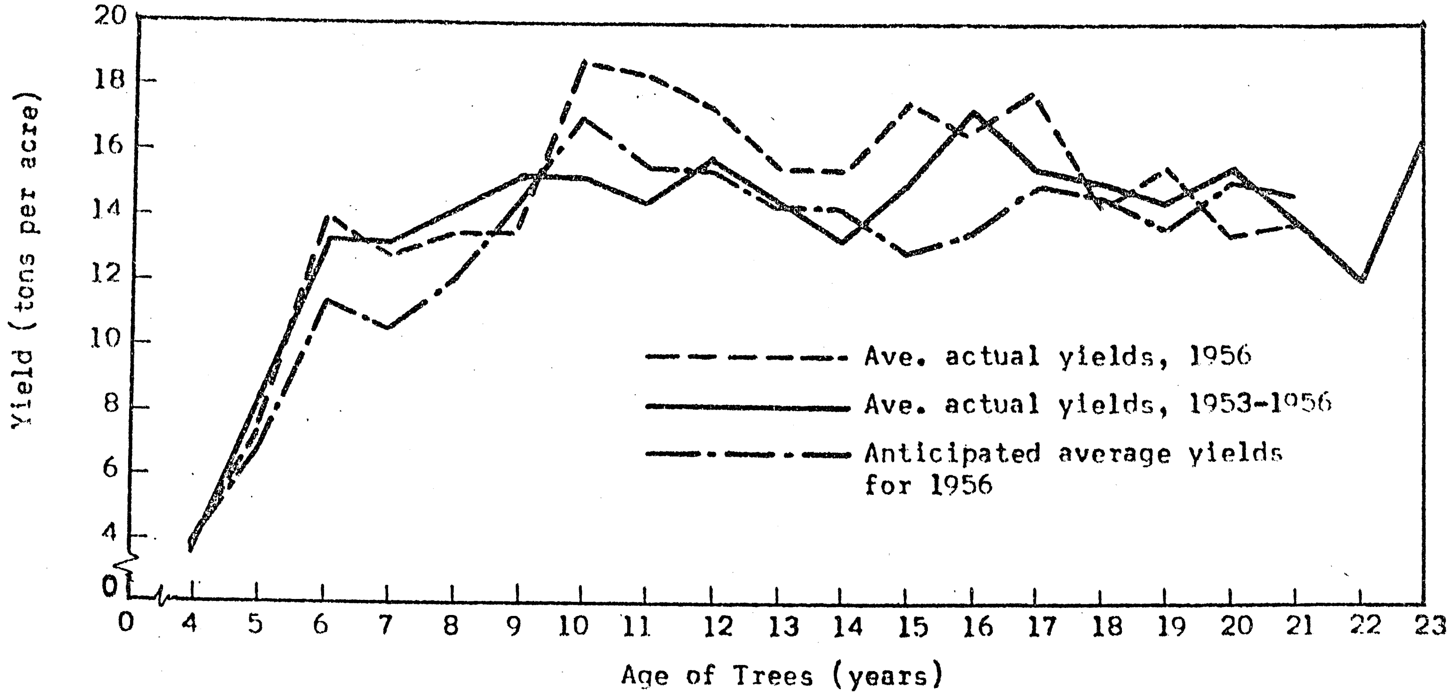


Figure 6. Yield Curve Fitted to Anticipated Average Yields for the 1956 Crop Year, Late Maturing Varieties, Yuba City and Modesto Areas

Early Maturing Varieties



Late Maturing Varieties

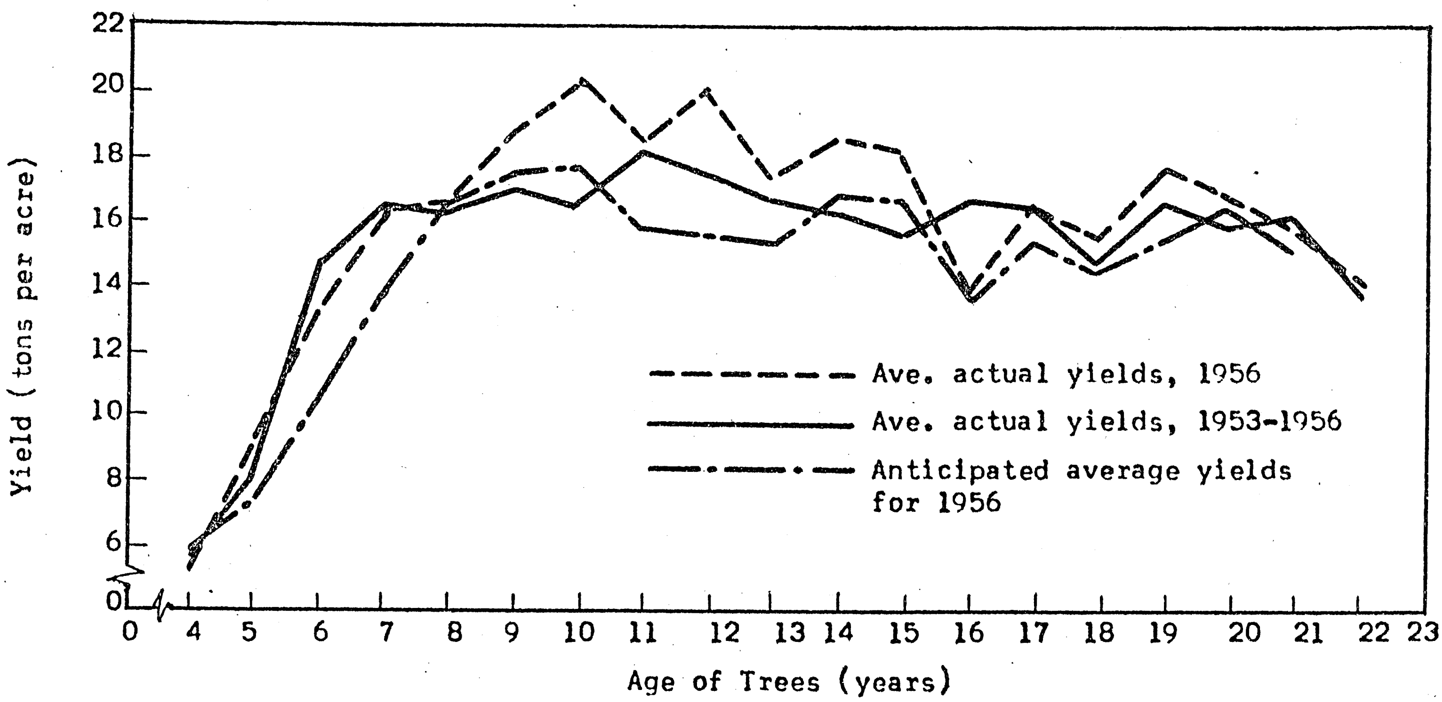


Figure 7. Average Actual Yields in 1956, in 1953 through 1956 and Average Anticipated Yields for 1956, Early Maturing and Late Maturing Varieties, Yuba City and Modesto Areas.

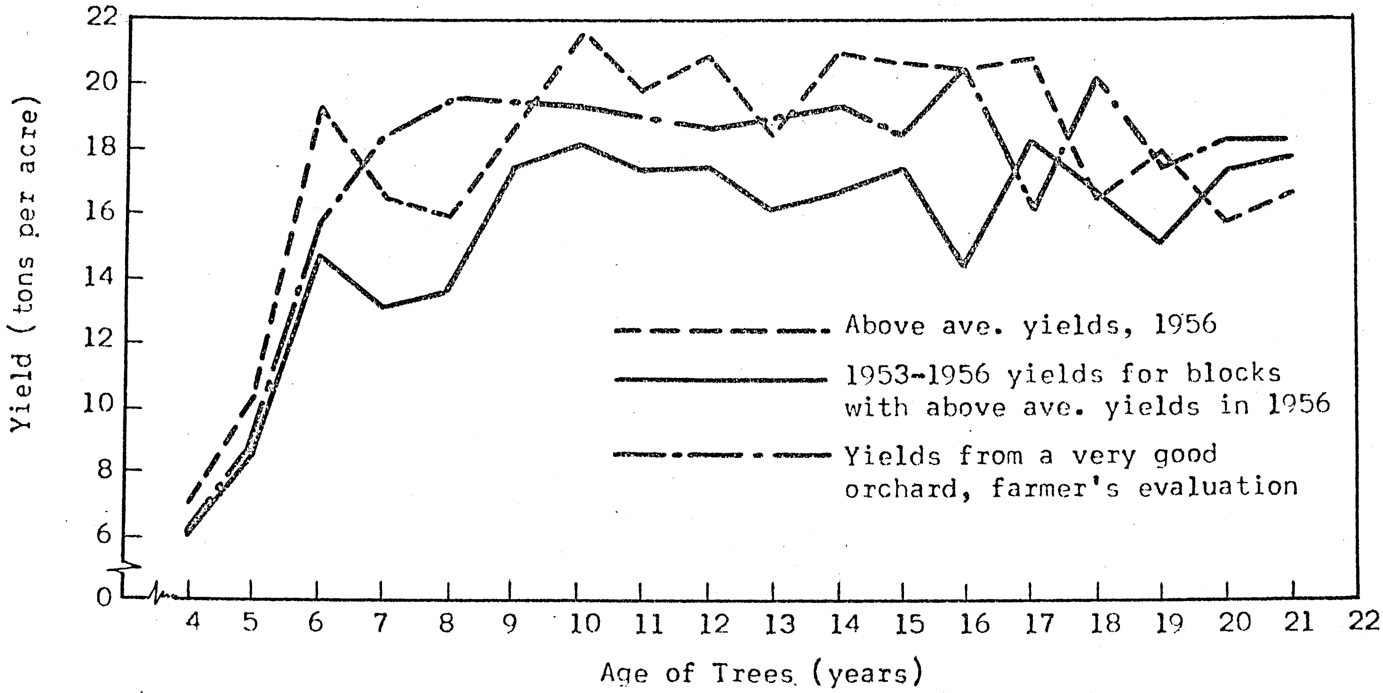
Above and Below Average Yields

The average yield curves are not applicable for a large number of orchardists. This is evident from the large variability in yields for trees of the same age (see Figures 3 and 4). In order to obtain yield curves that would be representative of a larger number of blocks of peaches the blocks were sorted into 2 groups; those with above average yields in 1956 and those with below average yields in 1956. Also in order to determine if those blocks of peaches with above (below) average yields in 1956 tended to be those blocks with above (below) average yields in other years, the yields for the blocks with above (below) average yields in 1956 were tabulated from the years 1953 through 1956.

In addition to asking the orchardists the question with respect to their anticipated average yields they were also asked, "What yield, for trees the same age as yours would you consider as a very good yield (and a) poor yield?" The purpose of these questions was to obtain additional information that could be used in constructing yield curves.

Above average yields in 1956, average yields in 1953 through 1956 for blocks of peaches with above average yields in 1956 and farmers' evaluations of yields from a very good producing orchard, are presented in Figure 8 for early and late maturing varieties. The yields from blocks with above average yields in 1956 are somewhat higher than farmers' evaluations of yields from a very good producing orchard in the 10th to 15th years but are considerably higher for the first 18 years than the 1953 through 1956 yields for blocks with above average yields in 1956.

Early Maturing Varieties



Late Maturing Varieties

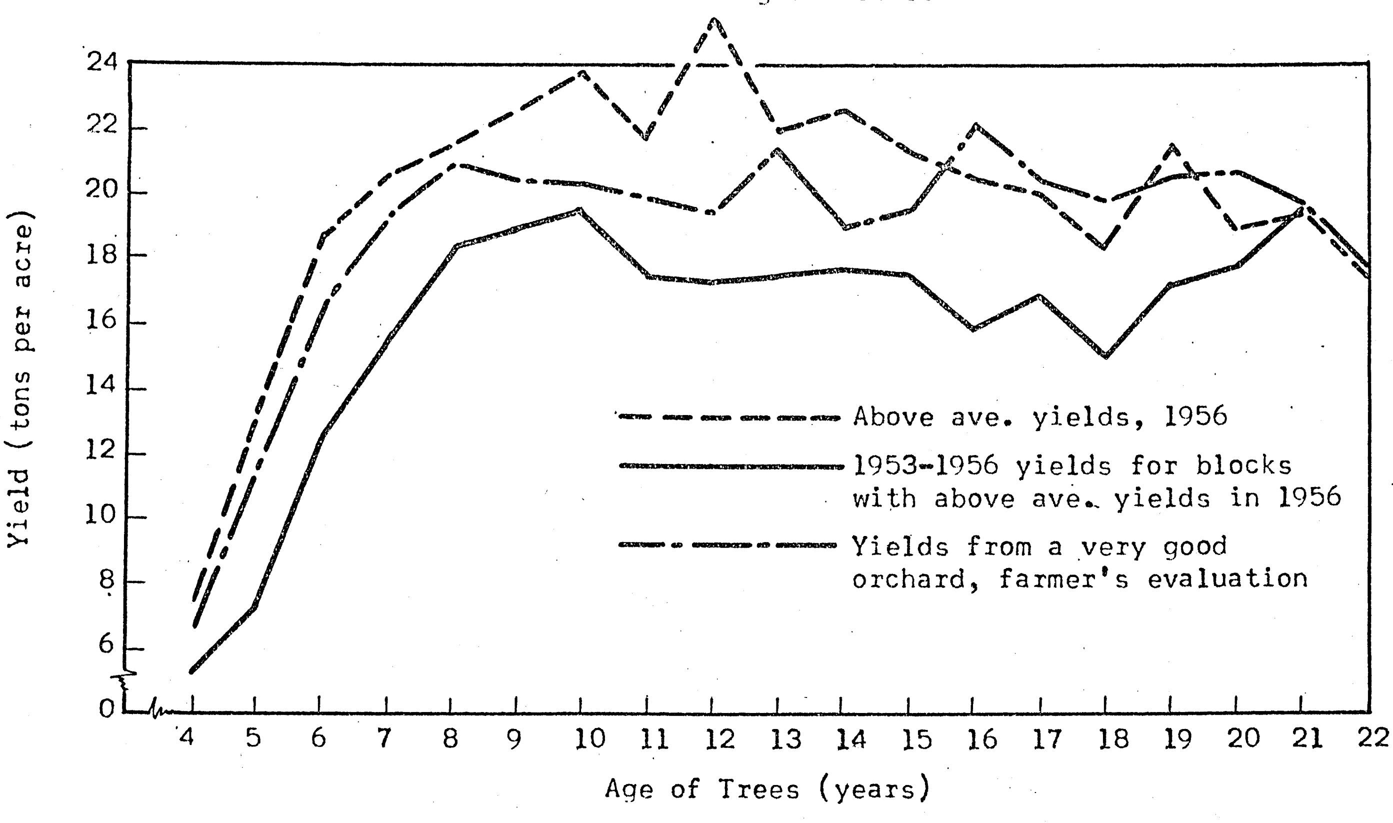


Figure 8. Above Average Yields in 1956, Yields in 1953 through 1956 for Blocks with Above Average Yields in 1956 and Farmer's Evaluation of Yields from a Very Good Orchard, Early Maturing and Late Maturing Varieties, Yuba City and Modesto areas.

Below average yields in 1956, average yields in 1953 through 1956 for blocks with below average yields in 1956 and the farmers' evaluations of yields from a poor orchard are presented in Figure 9 for early and late maturing varieties. The yields from blocks with below average yields in 1956 are very similar to the 1953 through 1956 yields for blocks with below average yields in 1956 but considerably higher than farmers' evaluations of yields from a poor producing orchard.

The data presented in Figures 8 and 9 indicate that blocks of peaches with above (below) average yields in 1956 did not necessarily have above (below) average yields in the previous years. However, the yields in 1953 through 1956 for blocks with above average yields in 1956 are considerably higher than the yields in 1953 through 1956 for blocks of peaches with below average yields in 1956.[1/] The farmers' evaluations of a very good or a poor producing orchard is consistent with anticipated yields in that all of the curves are much flatter in the 10th through 15th years than are the actual yield curves.

Cross Sectional Data

One of the major limitations of the data used to estimate yields over time is that it is cross sectional data. This results in an upward bias in yields for the older trees. The blocks of peaches with the poorer or lower yields are pulled or replaced first which leaves the better or higher yield blocks still producing. This overestimates yields of the older trees

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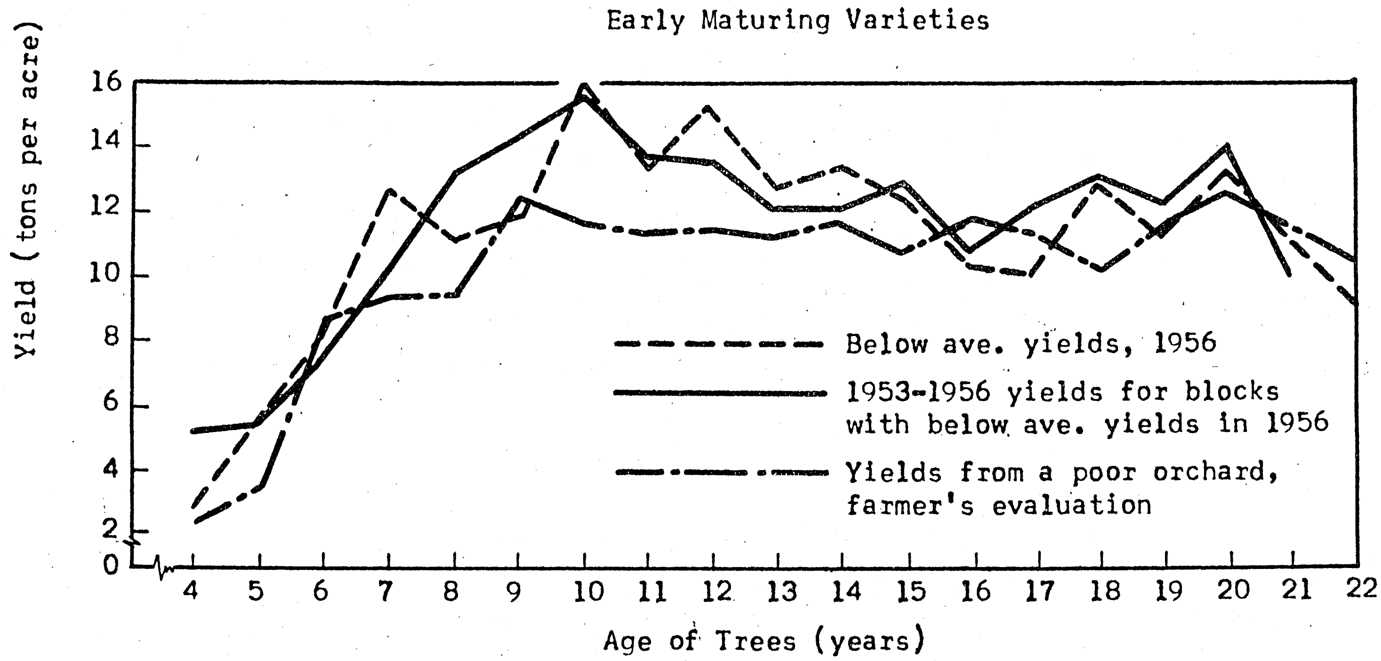
1/ This of course is biased by the 1956 yields. However, the difference is still quite large when 1956 yields are deleted from the comparison.



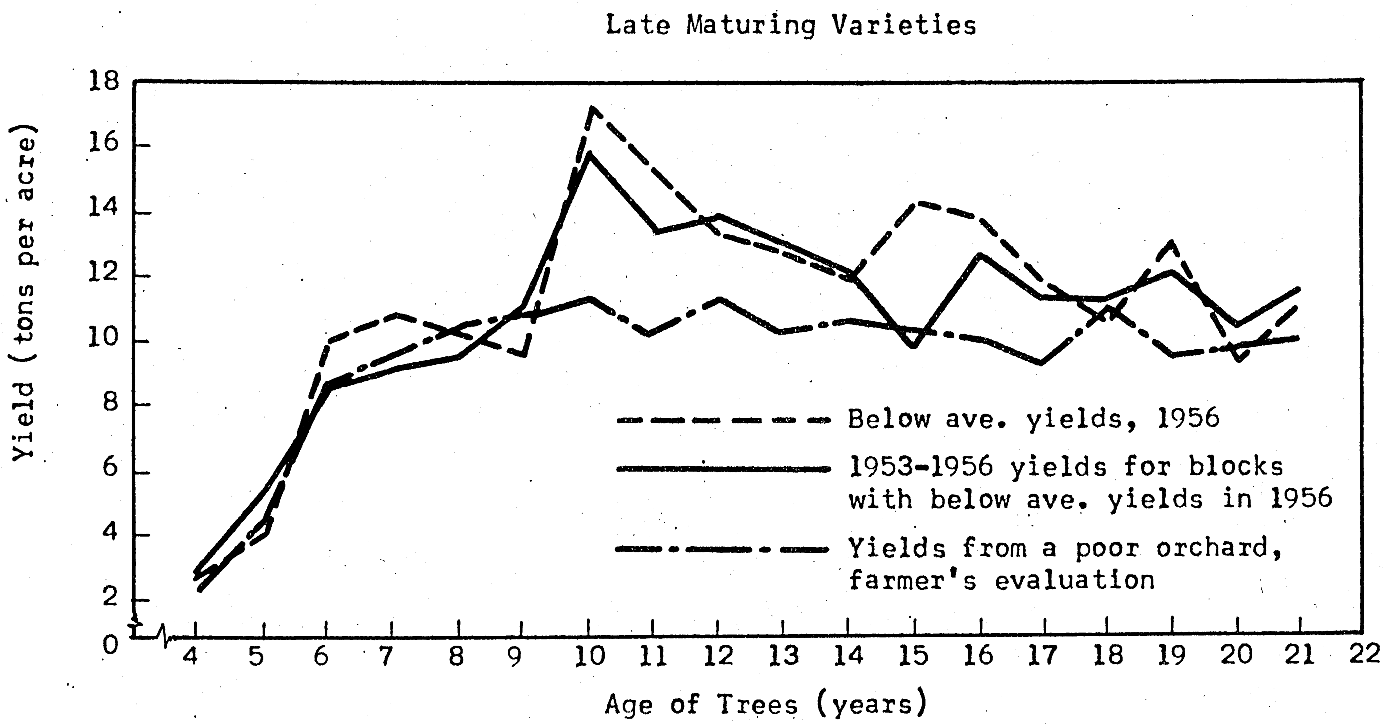


Figure 9. Below Average Yields in 1956, Yields in 1953 through 1956 for Blocks with Below Average Yields in 1956 and Farmer's Evaluation of Yields for a Poor Orchard, Early Maturing and Late Maturing Varieties, Yuba City and Modesto Areas

when the averages are computed. Also some of the trees in the older blocks may be replaced which tends to reduce per acre yields for a few years but then increases the yields per acre in later years. This upward bias is quite evident in a number of the previous figures showing yields over time.

Another limitation, in addition to the upward bias, is the few number of observations beyond the years in which the orchardists begin to replace their trees. In order to increase the number of observations in these years farmers were asked, "What yields would you expect from trees 5 years older?" Although this information was useful in increasing the number of observations it still did not compensate for the bias as those orchardists with relatively low yields stated that they would replace the present orchard within 5 years. However, when analyzing this information for the young blocks of peaches the anticipated yields for blocks of peaches 5 years older were very similar to the 1956 actual average yields.

A third limitation of cross sectional data is that it does not take into account the effect on yields of changes in technology. This is important if the orchardists expect the yields from the next orchard to be higher (or lower) than yields from the present orchard. In an attempt to investigate this problem the farmers were also asked the question, "What yields would you expect from trees 5 years younger (than your present trees)?" From this information it appears that many of the orchardists expect to obtain higher yields in the future than they are presently obtaining from trees in the 8 to 15 years old range. These yield expectations are very similar to the yield anticipations for trees 5 years older.

Thus it appears that the 1956 actual yields may be a fairly adequate indicator of anticipated yields in the near future although they were somewhat higher than the yields in the previous 3 years.

Synthesized Yield Curves

From the data presented in this section it is evident that there is a considerable amount of variation in yields for trees of the same age. Therefore a number of different yield curves over time will need to be investigated in order to take into account the various types of yield patterns over time that presently exist. Using the information on actual yields in 1956, the average of the 1953 through 1956 yields and the farmers' anticipations and evaluations with respect to yields representative yield curves were constructed for the early maturing varieties (Figure 10) and for the late maturing varieties (Figure 11). Three basic curves were constructed free hand for early maturing varieties and 3 were constructed for the late maturing varieties. These curves, shown by the solid lines in the figures, represent low, average or medium and high producing blocks of peaches. In addition to these basic curves 4 additional curves were constructed for the early maturing varieties and 6 additional curves constructed for the late maturing varieties. These curves were constructed to take into account the peak reached in about the 10th year for actual yields and the flatness from the 10th to the 15th year obtained in the anticipated average yields and farmers' evaluations of a very good and a poor producing orchard. It is the author's belief that all of these curves are necessary to adequately analyze the replacement problem. Even though some of these curves may not actually exist they are representative of the anticipations upon which farmers base their decisions.

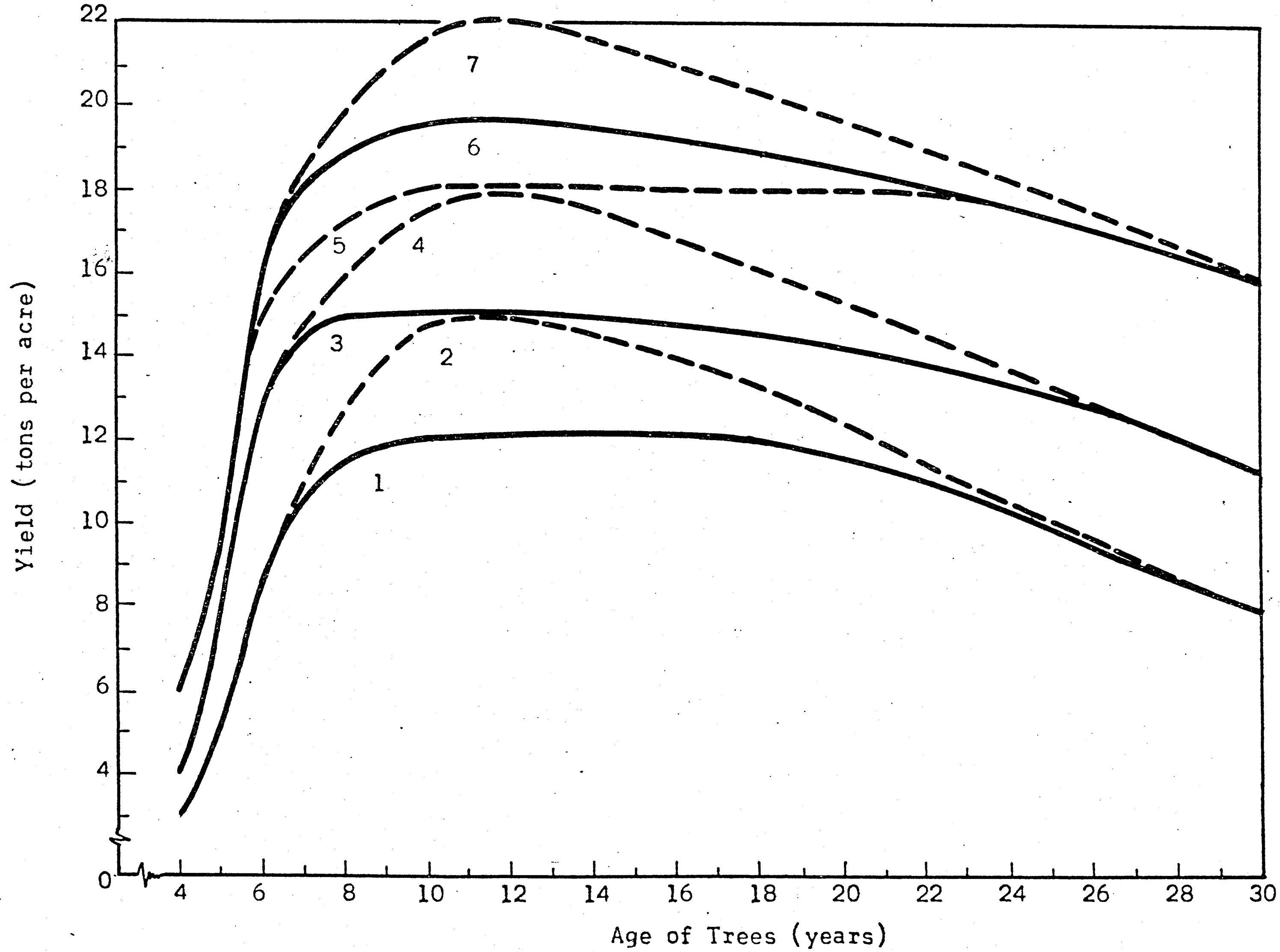


Figure 10. Representative Yield Curves for Cling Peaches, Early Maturing Varieties

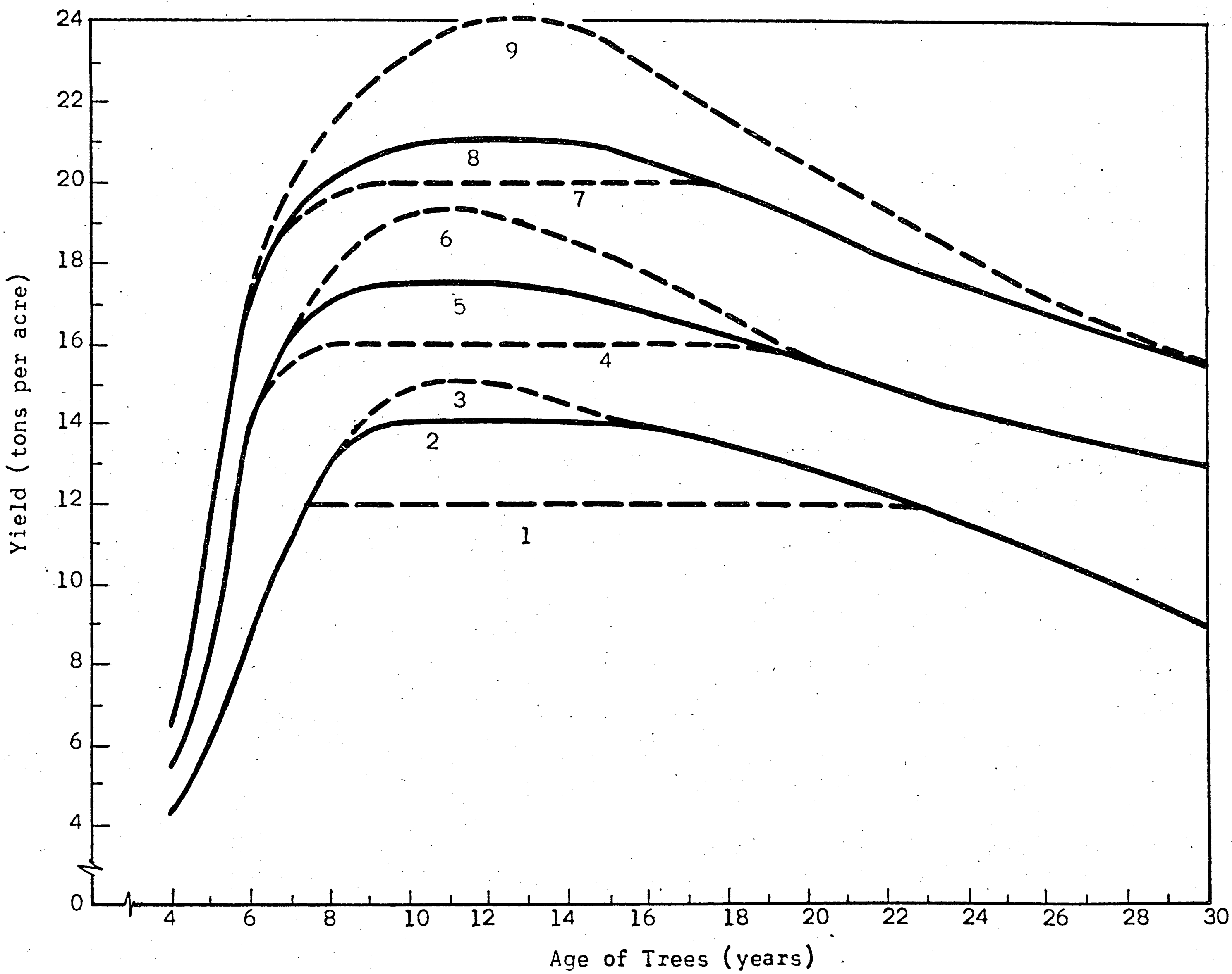


Figure 11. Representative Yield Curves for Cling Peaches, Late Maturing Varieties

V. COST OF PRODUCING CLING PEACHES

The cost of production by itself many times is rather meaningless. Costs vary from year to year and from one block of peaches to another. Thus, each orchardist has different costs associated with each block of peaches for each year. An attempt was made in this investigation to obtain representative costs. Whenever possible the costs were related to the physical inputs, i.e., hours of labor required. As physical inputs are less likely to change from year to year than costs of the inputs, it is much easier to revise the total cost of production if the physical inputs are associated with the costs. Although much of the physical input data was obtained in 1957 it has been revised in several instances to more accurately reflect the 1959 situation. All of the costs are based on 1958 and 1959 information.

In this section costs will be discussed in two parts. The first part will pertain to those costs that are incurred regardless of output, both the per acre output and the total output. The second part will pertain to the costs that vary with yield and/or time.

Costs Incurred Regardless of Output 1/

In order to obtain the appropriate fixed costs (those not varying with output) it is first necessary to determine the size of the operation in terms of the acres of orchard and the appropriate equipment complement. The average size of the cling peach orchards in the sample was 29 acres.

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1/ A summary of the costs that do not vary with output by age of tree is presented in Appendix B, Table 1.

However, more than 70 per cent of the farmers interviewed produced other fruits, nuts or berries commercially in addition to cling peaches. The average acreage of cling peaches, other fruits, nuts and berries was more than 44 acres. As much of the same type of equipment is used for other fruits and nuts as on cling peaches, the representative size orchard selected was a 40 acre cling peach orchard. However, as the largest percentage of cling peach orchards are less than 40 acres the effect of decreasing the size of the orchard will be investigated later in this study.

The equipment component necessary to operate 40 acres of cling peaches is presented in Table 2. The cost for the equipment was based on 1954 prices. Although prices for some of the equipment have increased considerably since 1954, much of the equipment was purchased a number of years ago. Using 1954 prices as a base was an attempt to compensate for this.

It was also assumed that the orchard had an underground irrigation system and buildings for housing some of the equipment.

Depreciation and Interest

The depreciation and interest, along with the investment, were computed for bare land, the irrigation system, buildings and equipment (Table 3). Not all of the equipment needed for a bearing orchard is necessary for a nonbearing orchard, i.e., picking buckets, ladders, etc. Therefore, the investment and consequently the depreciation and interest on the investment is somewhat lower for nonbearing trees. Interest is calculated at 6 per cent per annum. No interest or depreciation is charged for the trees.

TABLE 2

Equipment Requirements and Costs, 40 Acre Cling Peach Orchard

Equipment	Cost in 1954	Expected life	Annual depreciation
Tractor - 35 HP tracklayer	$ 5,400	15	$ 360.00
Tractor - 25 HP wheel	2,200	10	220.00
Pickup - 1/2 ton	1,800	8	225.00
Disk - 9' offset	750	6	125.00
Ridger - single	325	15	21.67
Harrow	150	15	10.00
Scraper - drag	150	15	10.00
Sprayer - 400 gal. speed	4,200	10	420.00
Pallet wagon - 4 pallets	450	20	22.50
Pallet wagon - 4 pallets	450	20	22.50
Ladders:			
5 - 12 foot	60	10	6.00
25 - 10 foot	250	10	25.00
Picking buckets and harness - 20	140	3	46.67
Pruning shears - 3 pair	20	4	5.00
Pruning saws - 3	10	5	2.00
Props - 4,000	1,200	20	60.00
Shop equip. & 5 HP motor & pump	750	15	50.00
Total cost	$18,305		$1,631.34

TABLE 3

Investment, Depreciation and Interest on Land, Irrigation System, Buildings and Equipment, 40 Acre Cling Peach Orchard

Item	Investment		Depreciation		Interest	
	per acre	total	per acre	total	per acre	total
Bare land	$1,000	$40,000	$ 0	$ 0	$60.00	$2,400.00
Irrigation system	125	5,000	5.00	200.00	3.75	150.00
Buildings	75	3,000	2.50	100.00	2.25	90.00
Equipment:[a]						
Nonbearing trees	394	18,305	36.22	1,631.38	11.82	549.30
Bearing trees	469		41.59		14.07	
Total						
Nonbearing trees	1,594)	66,305	43.72)	1,931.38	77.82)	3,189.30
Bearing trees	1,669)		49.09)		80.07)	

a/ It is assumed that 6 acres of the orchard is in nonbearing trees. The somewhat lower investment in equipment for nonbearing trees is taken into account. The trees are assumed to be nonbearing until they are 4 years old.

Actually the value of the trees is determined by the present value of expected future earnings from the trees. This varies by the age of the trees as well as by differences in expected yields for trees of the same age. This will be discussed in detail in a later section of this manuscript.

Taxes

Taxes vary considerably even for orchards within a close proximity of each other. Also taxes have been increasing at a rapid rate the past few years. The assumed assessed valuation of land and permanent improvements, trees and equipment are presented in Table 4. Taxes were calculated at the rate of $5.00 for $100 assessed value. These taxes will be too high for a large number of orchards but too low for others. However, it will not make any significant difference in determining the best time to replace cling peach trees.[1/]

Miscellaneous Costs

There are a group of costs that can be classified as miscellaneous costs. These include such items as licenses for equipment, insurance, office expenses and dues to business organizations. This amounted to approximately $9.00 per acre for the 40 acre cling peach orchard.

Costs That Vary with Output and Time

Costs that vary with output and time can be considered as variable costs at one point in time but not necessarily at all points in time. The planting cost, for example, is a variable cost in the planning stage but

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1/ This will be shown at a later point in the analysis.

TABLE 4

Assessed Value and Taxes Per Acre by Age of Trees

Age of tree	Assessed value of land and improvements	Assessed value of trees	Assessed value of equipment	Total assessed value	Taxes @ $5.00/$100.00 assessed value
1	$250	$ 60	$40	$350	$17.50
2	250	70	40	360	18.00
3	250	80	40	370	18.50
4	250	90	50	390	19.50
5	250	100	50	400	20.00
6	250	110	50	410	20.50
7	250	120	50	420	21.00
8	250	130	50	430	21.50
9	250	140	50	440	22.00
10	250	150	50	450	22.50
11	250	150	50	450	22.50
12	250	150	50	450	22.50
13	250	150	50	450	22.50
14	250	150	50	450	22.50
15	250	150	50	450	22.50
16	250	120	50	420	21.00
17	250	120	50	420	21.00
.	.	.	.	.	.
.	.	.	.	.	.
.	.	.	.	.	.
.	.	.	.	.	.
30	250	120	50	420	21.00

after the orchard is planted it becomes a fixed cost. Therefore, the term "variable costs" will not be used in the text as it may be somewhat misleading.

Much of the data on physical inputs required per unit of output or for trees of a certain age will be included in this section as these costs are based upon physical inputs. The cash cost per unit of use for some of the inputs is presented in Table 5. These costs do not include any of the so-called fixed costs that are associated with each of the inputs.

Planting Costs

A representative cost of planting an orchard is one of the most difficult costs to determine. This is primarily due to the cost associated with fumigation. In some orchards or blocks of an orchard it may not be necessary to fumigate while in other orchards or blocks it may be necessary to fumigate part or all of the soil. Also there is a tremendous difference in cost associated with the type of material used to fumigate. If some of the more expensive chemicals are used for fumigation the cost can be as high as $600 per acre. However, the usual practice is to only use the expensive chemicals on certain spots that are infected or to use the less expensive chemicals and to fumigate all of the area to be replanted. Of course, if the land to be planted to cling peaches is virgin soil, with respect to tree crops, it is doubtful if fumigation will be necessary.

The land is usually prepared for planting in the fall and winter months and the trees are planted bare root in the winter months. In this investigation trees in their first leaf (during the first spring, summer and fall) are considered as one year old trees. Thus trees planted in January 1955 are considered as being two year old trees in 1956.

TABLE 5

Cash Costs per Unit of Use for Certain Specified Inputs

Item	Cost
	dollars
Tractor - 35 HP tracklayer	1.25 per hour
Tractor - 25 HP wheel	.85 per hour
Pickup - 1/2 ton	.04 per mile
Disk - 9' offset	.50 per hour
Ridger - single	.20 per hour
Scraper - drag	.05 per hour
Harrow	.03 per hour
Sprayer - 400 gal. speed	1.90 per hour
Wagon - pallet	.10 per hour
Water	5.00 per acre
Labor	1.25 per hour unless noted differently

The physical inputs and their costs for replanting an acre block of cling peaches are presented in Table 6. The assumed cost for fumigation is $60.00 per acre. Although the cost of leveling and subsoiling may appear to be rather high the orchardists interviewed indicated that this would be about the cost that could be expected. The total cost of replanting an acre of cling peaches, $283.00, represents a rather large investment from which no revenue will be forthcoming for 3 or 4 years. In addition to the initial cost of replanting the cost of bringing the tree to the bearing age is also quite large.

Annual Costs and Inputs

The annual cash costs per acre by age of tree are presented in Appendix B, Tables 2-13. These are based upon the annual physical relationships and costs presented in this section and the costs presented in Table 5. Four types of information are presented for each of the major annual operations required to produce cling peaches. These are (a) the time of the operation, (b) the labor required, (c) the equipment required, and (d) the supplies required.

TABLE 6

Costs per Acre for Replanting a Block of Cling Peach Trees[a/]

Operation	Labor, equipment and supplies	Cost per acre
Pull and haul old trees	3 hours per acre. Hire man and bulldozer @ $12/hour	$ 36.00
Burn old trees	3 hours per acre (man to tend fires)	3.75
Pick up wire, etc.	1 hour of labor per acre	1.25
Level and subsoil	custom operation @ $80/acre	80.00
Pick up roots, etc.	5 hours of labor per acre	6.25
Float	.5 hours per acre for 1 man and tractor	1.25
Fumigate	cutom operation @ $60/acre	60.00
Mark and stake	6 hours per acre (3 men can do an acre in 2 hrs. using wire and template)	7.50
Dig holes	custom operation @ $.07/hole	7.00
Plant trees	4 hours of labor to plant 100 trees per acre, trees cost $.75 each	80.00
Total		$283.00

a/ In addition to the above costs there is the cost of replanting trees that die the first few years. It is assumed that two trees must be replanted the first year at a cost of $2.50 and that one tree must be replanted the second year at a cost of $1.25.

Pruning

a. Time of operation: November 1 to March 1.

b. Labor required: the physical inputs are presented in Figure 12. The labor cost is assumed to be $1.10 per hour. For trees 8 years or older the cost would be approximately $.57 per tree. This corresponds quite closely to the present pruning cost per tree if labor is paid on the per tree basis

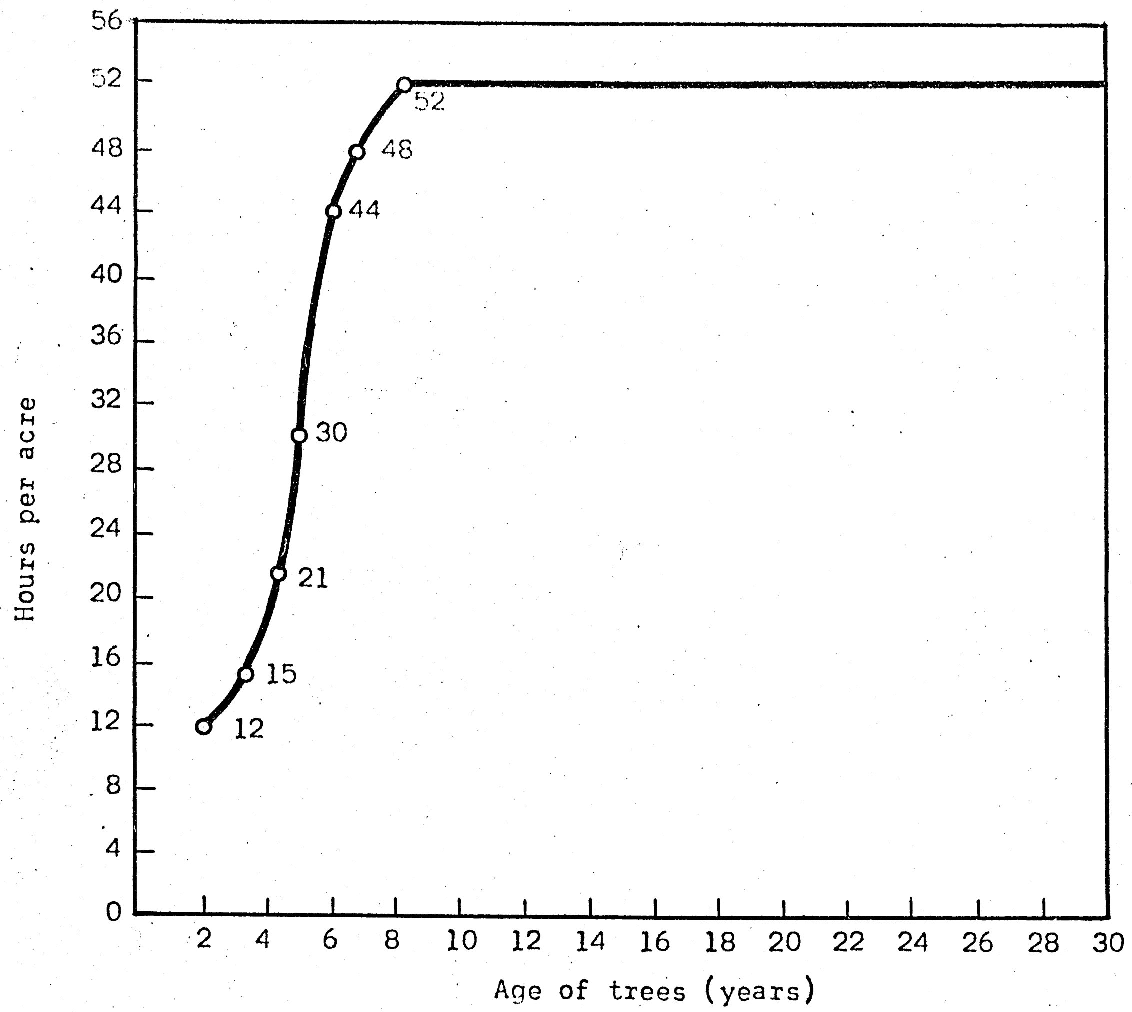

Figure 12. Labor Requirements per Acre for Pruning by Age of Tree

c. Equipment required: ladders, pruning shears and pruning saws.

d. Supplies required: none

Brush Disposal

a. Time of operation: January 1 - March 15

b. and c. Labor and equipment required:

Trees 2 to 6 years of age

Disc under the brush

1 man)
1 tractor) 2 acres per hour
1 disc)

Trees 7 and over years of age

Haul out and burn larger limbs

1 man)
1 tractor) .67 acres per hour
1 disc)

Disc the remaining brush under

1 man)
1 tractor) 2 acres per hour
1 disc)

d. Supplies required: a negligible quantity of oil to start fires.

Thinning

a. Time of operation: May 1 to June 15.

b. Labor required: The costs per acre, based on 100 trees per acre, are presented in Figure 13. Thinning costs are determined by the set of the peaches as well as the age of the tree. The above figure is for a normal to heavy set for good producing trees. As it is the usual practice to pay for thinning by the tree rather than the hour the physical requirements are not stated.

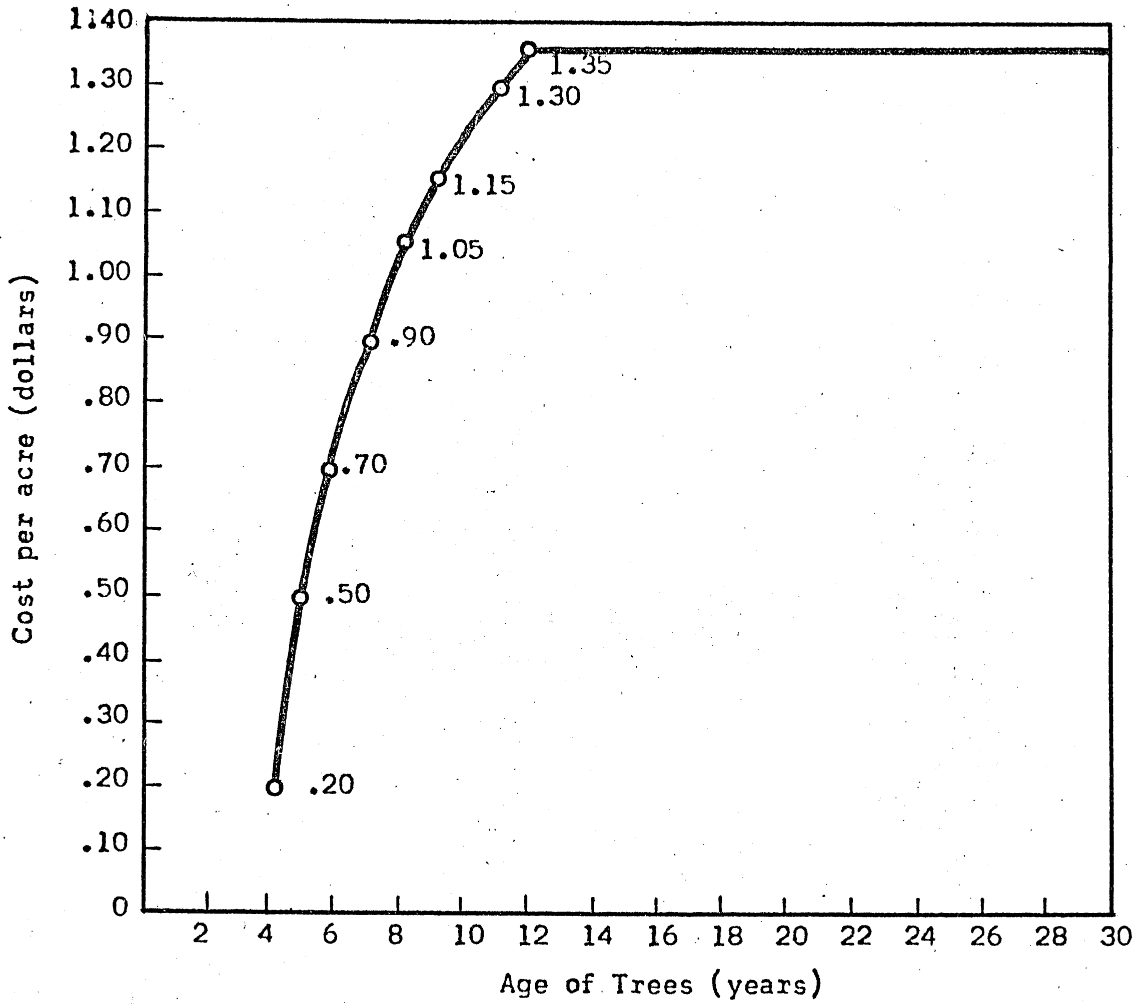

Figure 13. The Cost of Thinning per Acre by Age of Tree

c. Equipment required: Ladders.

d. Supplies required: none

Fertilization

a. Time of operation: First application December or January
Second application May or June

b. Labor required: .25 hours per acre per application

c. Equipment required: wheel tractor
fertilizer spreader (rented or borrowed)

d. Supplies required: (See Table 7)

TABLE 7

Fertilizer Requirements per Acre by Age of Tree

Age of tree years	First application pounds of ammonium sulfate per tree	Second application pounds of ammonium nitrate per tree	Total pounds of nitrogen per acre	Total cost per acre a/
1	.5	.3	20	$ 3.00
2	1.0	.7	40	6.00
3	1.6	1.0	65	9.75
4	2.2	1.5	88	13.20
5	2.8	1.8	110	16.50
6	3.3	2.2	132	19.80
7	3.3	2.2	132	19.80
8	3.7	2.4	150	22.50
9	3.7	2.4	150	22.50
.	.	.	.	.
.	.	.	.	.
.	.	.	.	.
.	.	.	.	.
30	3.7	2.4	150	22.50

a/ The price of nitrogen is assumed to be $.15 per pound.

Roping and Wiring

a. Time of operation: February and March

b. and d. Labor and supplies required: (See Table 8)

c. Equipment required: pick up truck
ladders

TABLE 8

Labor and Supplies for Roping and Wiring per Acre by Age of Tree

Age of tree years	Operation	Hours per acre	Supplies
1	none	0	none
2	none	0	none
3	none	0	none
4	rope trees	5	3250 feet of rope @ $.07/foot = $22.75
5	check ropes	1	none
6	wire trees	10	125 pounds of #12 wire @ $.12/lb. = $15.00
7	check wires	1	none
8	check wires	1	none
9	wire trees	10	150 pounds of #12 wire @ $.12/lb. = $18.00
10	check wires	1	none
.	.	.	.
.	.	.	.
.	.	.	.
.	.	.	.
30	check wires	1	none

Propping

a. Time of operation: Four to six weeks before harvesting.

b., c. and d. Labor, equipment and supplies required: (See Table 9).

TABLE 9

Labor, Equipment and Number of Props Required per Acre by Age of Tree

Age of tree years	Hour of labor per acre	Hour of tractor and trailer time per acre	Number of props per acre
1	0	0	0
2	0	0	0
3	0	0	0
4	0	0	0
5	1	.2	60
6	2	.3	120
7	3	.4	180
8	4	.5	240
9	5	.5	300
.	.	.	.
.	.	.	.
.	.	.	.
.	.	.	.
30	5	.5	300

Irrigation

a. Time of operation: April through September

b. and d. Labor and supplies required: (see Table 10). Trees under 4 years of age are irrigated 5 times per year and trees 4 years old and older are irrigated 7 times per year.

c. Equipment required: Shovels. The preparation of the orchard for irrigation is considered under the tillage operations (Table 11).

TABLE 10

Labor and Water Requirement per Acre
by Age of Tree

Irrigation	Trees under 4 years old		Trees 4 years old and older	
	hours of labor per acre	acre inches of water per acre	hours of labor per acre	acre inches of water per acre
First	2.0	8	2.0	8
Second	1.0	5	1.0	5
Third	1.0	5	1.0	5
Fourth	1.0	5	1.0	5
Fifth	1.0	5	1.0	5
Sixth	--	--	1.0	5
Seventh	--	--	1.0	5
Total	6.0	28	8.0	38

Tillage Operations (including cover crop)

a. Time of operation: Four times a year for trees 4 years old and older. Once in the spring, once in the summer, once in the fall and the cover crop is planted in November.

b. and c. Labor and equipment required: (see Table 11).

d. Supplies required: 30 pounds of vetch seed per acre @ $.08 per pound = $2.40.

TABLE 11

Labor and Equipment Requirements per Acre for Tillage and Cover Crop Operations on Trees Four Years Old or Older

Operation	Equipment used	Hours of labor per acre	Hours of equipment time per acre
Tillage a/			
Double disc (3 times)	disc	2.4	2.4
Ridge (3 times)	ridger	1.8	1.8
Knockdown checks (3 times)	inverted ridger	1.8	1.8
Cover crop			
Double disc	disc	.8	.8
Harrow	harrow	.2	.2
Seed cover crop	grain drill b/	.4	.4
Total	--	7.4	7.4

a/ These operations are carried out only 2 times per year for trees under 4 years of age. Thus, only 5.4 hours of labor and 5.4 hours of equipment time are required for the young trees.

b/ Rents a grain drill @ $4.00 per day. Therefore, it costs $.20 per acre to rent the drill if there are 40 acres of peaches.

Spraying

a. Time of operation: Fall spray - November 15 to December 1
Pink bud spray - February
May spray - May
July spray - July
An additional spray or dusting may be required sometime within the year.

b., c. and d. Labor, equipment and supplies required: (see Table 12).

TABLE 12

Labor, Equipment and Supplies Required per Acre for Spraying

Age of tree years	Number of sprays per year	Gallons of spray per tree		Total gallons per acre	Hours of labor per acre a/	Hours of equipment time per acre b/	Total material cost per acre
		not in leaf	in leaf				
1	1	.50	.5	50	.3	.25	$ 1.80
2	2	.50	.6	110	.6	.50	3.30
3	3	.50	.6	170	.9	.75	4.80
4	4	.80	1.0	380	1.3	1.10	10.00
5	4	1.70	2.0	770	1.5	1.25	20.00
6	4	2.50	3.0	1,150	1.7	1.40	30.00
7	4	3.33	4.0	1,533	2.0	1.50	40.00
.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.
30	4	3.33	4.0	1,533	2.0	1.50	40.00

a/ Assume that the operator can spray 2 acres per hour on trees 7 years of age and older. This includes filling the tank as well as the actual spraying operation.

b/ The equipment required includes a tracklayer, a 400 gallon speed sprayer and a 5 HP engine and pump to fill the spray tank.

a. Time of operation: Extra early varieties - July 15 to August 1
Early varieties - August 1 to August 15
Late varieties - August 15 to September 1
Extra late varieties - September 1 to September 20

b. Labor required: The picking cost is assumed to be $10.50 per ton. The labor required for hauling is presented in Figure 14.

c. Equipment required: Ladders for picking. A tractor or tractors, trailers or pallet wagons and a pick-up truck are required for hauling (see Figure 14). It costs $.15 per ton to operate the pick-up truck which is used to pull the pallet wagons to the receiving station.

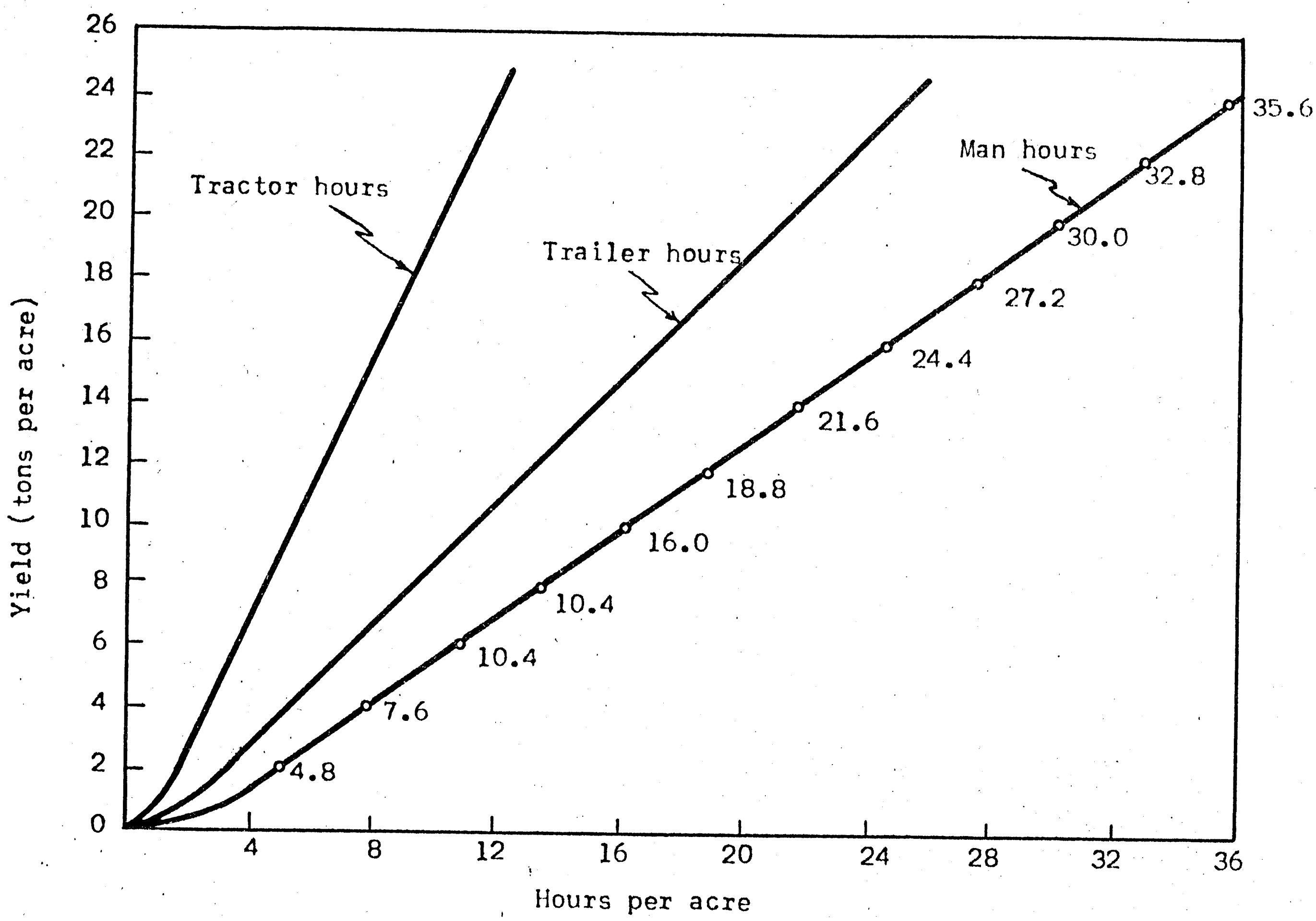

Figure 14. Tractor, Trailer and Man Hours Per Acre Required to Harvest Peaches by Yield Per Acre

d. Supplies required: Boxes from receiving station.

Miscellaneous costs.--There are several annual costs that have not been included in the previous discussion. These are the costs associated with such items as the annual leveling with a scraper, cost of operating the pickup truck ($8.00 per acre), compensation insurance, social security payments and interest on operating costs. These costs are presented in Appendix B, Tables 2 through 13. In addition to these costs there is one additional cost of large magnitude. This is the interest on the unpaid balance of the establishing costs. Because of the lag between the time that the establishing costs are incurred and the time that the return from the trees has covered these costs it is necessary to charge interest on the unpaid balance of the establishing costs. The magnitude of this cost, after the trees begin to bear, is a function of yields and the price received for cling peaches.

VI. ANALYTICAL TECHNIQUES USED IN DETERMINING THE OPTIMUM REPLACEMENT PATTERN FOR CLING PEACHES

There is no specific name for the type of techniques that will be used in determining the optimum replacement pattern. Essentially it is a process of valuing the net revenues from the present orchard of cling peaches and the immediately following orchard in such a manner that they can be logically compared. The optimum replacement pattern will be approached in terms of maximizing revenue over time. Because of the lack of literature pertaining to these analytical techniques it would appear appropriate to develop the concepts in several stages.[1/] Therefore, a simplified model will be used to introduce some of the basic concepts. This model will then be refined to include the remainder of the basic concepts. The refined model will serve as a basis for the rest of the analysis in this investigation.

The Simplified Model

Yields, costs and revenues per acre by the age of the cling peach trees are presented in Table 13 for yield anticipation number 6, late maturing varieties.[2/] It will be assumed for the present time that the

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1/ Dr. H. R. Shaw of the University of California at Davis is presently investigating the optimum replacement of equipment in terms of minimizing costs. In Dr. Shaw's investigation the total revenue is assumed to remain constant but certain costs, e.g., depreciation, vary with use. In this investigation the physical inputs and their related costs are specified and total revenue varies over time.

There have been a number of articles written on the optimum replacement age for timber production. An excellent critique of the techniques that have been used in determining the optimum replacement date is presented by M. Mason Gaffney, Concepts of Financial Maturity of Timber, Dept. of Agr. Econ., A.E. Information Series No. 62, Raleigh, September 1957. The technique used in this investigation differs from any of the techniques mentioned by Mr. Gaffney.

2/ Throughout the remainder of this investigation the representative yield curves constructed in Figures 10 and 11 will be referred to as yield anticipation curves. The yield curve used in this illustration is the curve labeled number 6 in Figure 11.

TABLE 13

Yields, Costs and Revenues per Acre by Age for Yield Anticipation 6, Late Maturing Varieties a/

Age of tree (years)	Yield (tons)	Gross revenue b/	Annual cost c/	Unadjusted annual net revenue	Interest on unpaid balance d/	Adjusted accumulated net revenue	Adjusted annual net revenue	Average net revenue
0	0	$ 0	$283	$-283	$ 0	$- 283	$-283	--
1	0	0	199	-199	17	- 499	-216	$-499
2	0	0	220	-220	30	- 748	-250	-374
3	1.0	60	242	-182	45	- 976	-227	-325
4	5.5	330	393	- 63	59	-1,097	-122	-274
5	8.5	510	464	46	66	-1,117	- 19	-223
6	14.0	840	619	221	67	- 963	154	-160
7	16.2	972	664	308	58	- 713	250	-102
8	17.8	1,068	711	357	43	- 398	314	- 39
9	18.7	1,122	766	356	24	- 66	332	- 7
10	19.2	1,152	753	399	4	329	395	33
11	19.4	1,164	762	402	0	730	402	67
12	19.3	1,158	766	392	0	1,122	392	93
13	19.0	1,140	762	378	0	1,499	378	115
14	18.6	1,116	757	359	0	1,858	359	133
15	18.2	1,092	752	340	0	2,199	340	147
16	17.7	1,062	744	318	0	2,517	318	157
17	17.3	1,038	738	300	0	2,817	300	166
18	16.8	1,008	732	276	0	3,093	276	172
19	16.2	972	724	248	0	3,342	248	176
20	15.6	936	716	220	0	3,562	220	178
21	15.3	918	712	206	0	3,769	206	179
22	14.8	888	705	183	0	3,952	183	180
23	14.5	870	701	169	0	4,121	169	179
24	14.4	864	700	164	0	4,285	164	179
25	14.1	846	696	150	0	4,436	150	177
26	13.9	834	693	141	0	4,577	141	176
27	13.6	816	689	127	0	4,704	127	174

a/ The figures may not always add up correctly because of rounding errors.

b/ The price per ton of cling peaches is assumed to be $60.00.

c/ The annual cost includes pre-harvest and harvest variable costs, interest on operating capital and fixed costs. The annual cost also includes the planting costs. This amounts to $283.00 in year 0, $2.50 in year 1 and $1.25 in year 2.

d/ The interest rate is assumed to be 6 per cent per annum.

yields, costs and revenues from the present orchard are identical with those from the orchard that will follow. Therefore, Table 13 can be used for both the present orchard and the orchard immediately following. It is important to understand how the figures in Table 13 were obtained. Therefore, each column in this table will be discussed.

The age of the trees begins at year zero. Year zero includes the time required to prepare the land for planting and the initial planting of the trees. In this illustration it is assumed that the trees are planted as soon as possible after the trees are dormant. Year 1 begins immediately after the trees are planted and continues for a calendar year. Thus all revenues and operating costs are allocated on the crop year basis. The gross revenues are obtained by multiplying the yields by $60.00 per ton. The planting costs and annual costs were obtained from the previous section. The annual costs include pre-harvest and harvest variable costs, interest on the annual operating capital and fixed costs.[1/] The unadjusted annual net revenue is obtained by subtracting the planting costs and annual costs from the gross revenue. The planting costs and the annual costs are greater than the gross revenue for the first 4 years. However, the accumulated costs are greater than the accumulated gross revenue for even a longer period of time. It is necessary to charge interest on this unpaid balance (the negative accumulated net revenue) as it is a cost (either actual or alternative) to the cling peach enterprise. It is assumed that the

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1/ In Table 13 the planting costs are included under the annual costs. The fixed costs and pre-harvest variable costs by age of tree have been summarized in Appendix B, Tables 1 through 13.

interest payments are paid at the end of the year on the unpaid balance at the beginning of the year. The interest on the planting costs in year zero is paid in year 1, etc. Therefore, the interest on the unpaid balance in year n is obtained by multiplying the adjusted accumulated net revenue in year n-1 by the appropriate interest rate.

The operator may have set-up the replacement schedule for establishing costs over a longer period of time than the time when accumulated net revenue becomes greater than zero. This would result in a larger amount of interest being paid than if the establishing costs had been repaid as soon as possible from the net revenue obtained from the cling peach enterprise. This is irrelevant, however, when determining the revenues from the enterprise. The additional interest paid by the operator should not be charged to the cling peach enterprise but rather to personal consumption or other enterprises. The next to last column in Table 13 is the adjusted annual net revenue. This is obtained by subtracting the interest on the unpaid balance from the unadjusted annual net revenue. The adjusted annual net revenue can also be considered as the marginal net revenue as it indicates the net revenue forthcoming if the present orchard is kept an additional year. The average net revenue is presented in the last column.

In order to simplify the problem it is assumed that costs and revenues are not discounted. Thus there is no discounting because of uncertainty or time preference.

Maximizing Revenue per Tree

It is a well established principle in economics that to maximize net revenue, assuming no capital restrictions, the operator should produce at the point where the marginal cost is equal to the marginal revenue from an enterprise. The cost of time or associated with time may be important for some enterprises such as the cling peach enterprise where the number of trees (and their products) that can be produced in a given time period can vary. For example, one 30 year old tree or two 15 year old trees can be produced in a span of 30 years on the same plot of ground. If no cost is attached to time, i.e., the marginal cost of using the fixed resources an additional year for the present trees is zero, the operator will attempt to maximize net revenue per tree or per block of trees. In the above illustration this will occur when the yield declines to 11 tons per acre. This is not shown in Table 13 but for the purposes of comparison it will be assumed that this will occur when the trees are approximately 35 years old. Thus MC = MR (when the marginal cost does not include any cost for time) and net revenue is maximized when the trees are approximately 35 years old. This is appropriate when the operator does not expect to immediately replace the present block of trees with another block of trees or other crops. However, if the operator expects to immediately replace the present block of trees with another block the maximum net revenue per block is unlikely to result in the maximum net revenue over time.

Maximizing Revenue with Respect to Time

The major problem encountered in maximizing revenue with respect to time is the problem of determining the value of time. In other words, how much is an extra year worth? Obviously the value of an extra year period is determined by the alternative use for the fixed resources in this period of time. If the land upon which the trees are planted is to be used continuously then time will have some value. The alternative to keeping the trees another year is to pull them and replace them with another block of trees. If replacement is not planned within this year period the opportunity cost is zero providing the cling peach enterprise is the only alternative available.

The following discussion will assume immediate replacement in the cling peach enterprise. One method of determining the value of time is to calculate the net revenues from an enterprise replaced every j years as compared to the same enterprise replaced every k years over a period of n years. For example, the net revenue from trees replaced every 15 years can be compared with the net revenue from trees replaced every 16 years over a period of 240 years. Although this comparison is unrealistic because of the length of time under consideration it will be used to illustrate a basic principle that is involved. Using the information in Table 13, the net revenue from trees for the first 15 year period is $2,199 per acre and the net revenue from trees for the first 16 year period is $2,517 per acre. The total net revenue for the 240 year period is $35,184 when the trees are replaced every 15 years and $37,755 when the trees are replaced every 16 years. The net revenue for a 240 year period, then, is increased by $2,571 when the replacement cycle is increased from 15 years to 16 years. The increase in net revenue per year is approximately $10.71 ($2,571 ÷ 240). This is an estimate of the marginal value of time per year between a 15 year and a 16 year replacement cycle with immediate replacement. Thus the net revenue will be maximized over time when the marginal value of time is equal to zero.

The marginal value of time can also be expressed in terms of the change in the average net revenue per unit of time.1/ It is the slope of the average net revenue curve. Therefore, rather than use the method demonstrated above to obtain the marginal values of time it is more convenient and realistic to use the information presented in Table 13. With immediate replacement the stream of net revenue is maximized (the marginal value of time is zero) when the average net revenue is at a maximum for each block. This occurs at the end of the first 22 feeding periods in the illustration used (see Table 13).

1/ The method used to obtain the marginal value of time can be expressed algebraically as:

$$\frac{\frac{n}{k} NR_k - \frac{n}{j} NR_j}{n}$$

where

j = the number of years in a replacement cycle

k = a replacement cycle (in years) different than j

n = the total number of years over which net revenue is to be compared

NR_j = the net revenue from the first j years.

NR_k = the net revenue from the first k years

The above equation can be reduced to

$$\frac{NR_k}{k} - \frac{NR_j}{j}$$

Thus far it has been assumed that the prices, costs and physical relationships do not change. Thus, for a replacement cycle of j years the average net revenue is the same for each succeeding block. In order to have the principles of optimum replacement on a realistic and workable basis it is necessary to consider the opportunity cost associated with time. The following discussion will attempt to determine the opportunity cost for the type of enterprise under consideration. It has been pointed out that to maximize net revenue over time it is necessary to replace each lot when the average net revenue (ANR) is at a maximum. However, when ANR is at a maximum it is equal to marginal net revenue (MNR) for the same lot.[1/] Therefore, the maximum flow of net revenue is obtained when

(1) MNR = ANR

It has been assumed that $ANR_{t_o} = ANR_{t_1} = \ldots = ANR_{t_n}$ where t_o is the present block, t_1 is the immediately following block and t_n is the n^{th} block of cling peach trees. Under this assumption the MNR and the ANR could have reference to any time period, i.e., $MNR_{t_1} = ANR_{t_5}$ without changing the optimum time to replace each block. This is not very realistic as prices and costs, as well as the physical relationships, are expected to change over time. Also the operator's horizon, with respect to definable expected prices, costs and/or physical relationships, may not extend very far into the future.

To utilize the concept of opportunity cost it is necessary to restate Equation (1) in terms of a time sequence. Therefore, it may be restated as

(2) $MNR_{t_{n-1}} = \text{max. } ANR_{t_n}$

1/ The proof of this can be found in most intermediate economic theory text books and further proof should not be needed here.

or more specifically as

$$(3) \quad MNR_{t_o} = \text{max. } ANR_{t_1}$$

where MNR_{t_o} is the marginal net revenue from the present block of peaches and max. ANR_{t_1} is the maximum average net revenue from the block of peaches replacing the present block. Equation (3) states that to maximize net revenue over time the present block is replaced when its marginal net revenue is equal to the highest average net revenue of the following block of peaches. Therefore, the opportunity cost to the present block of peaches is the highest average net revenue that can be obtained from the immediately following block.

This point can be further illuminated by comparing the conditions under which net revenue is maximized <u>without</u> respect to time (the maximum per tree or block) and the conditions under which net revenue is maximized <u>with</u> respect to time (maximum for a number of blocks with immediate replacement). Net revenue is maximized <u>without</u> respect to time when the

$$(4) \quad MNR_{t_o} = 0$$

By comparing Equation (3), maximizing <u>with</u> respect to time, with Equation (4) it is readily evident that the max. ANR_{t_1} is the opportunity cost associated with time.

The replacement principle to follow for the simplified model where costs and revenues are not discounted can now be stated.1/ <u>The optimum time to replace is when the marginal net revenue from the present enterprise is equal to the highest average expected net revenue from the enterprise immediately following</u>.

1/ This replacement principle is applicable for enterprises with short production periods such as a feeder cattle enterprise where the costs and revenues do not need to be discounted.

This replacement principle will permit an optimum replacement time to be obtained when prices, costs and/or physical relationships change. For example, assume that the operator expects the price of peaches to decrease $5.00 per ton to $55.00 per ton. Then all that he has to do is to determine the year in which the marginal net revenue (annual net revenue) is equal to the average net revenue under the price assumption of $55.00 per ton for cling peaches.

The Refined Model

The problem of determining the optimum replacement pattern is complicated by introducing a long-run production period. The complications arise as a result of uncertainty and time preference.

Discounting Returns and Compounding Costs

There are two basically different types of discounting to consider. The first type is that of using lower yields, lower prices and/or higher costs in calculating the expected net revenue. This is discounting because of uncertainty with respect to yields, prices or costs. It does not usually entail the use of a mathematical discounting formula but rather the application of lower per unit prices and/or higher per unit costs to the existing production function or the application of present per unit prices and costs to a lower production function or both.[1/]

The second type of discounting is that arising from time preference. The logic behind discounting because of time preference is that a sum of

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1/ A lower production function is defined as a production function that results in a smaller output from the same quality and quantity of inputs.

money received or paid at the present time is worth more than the same sum of money at some time in the future. This is primarily a function of opportunity costs and indifference patterns. The more distant the time that the money is to be received or paid the less is the value that the firm or individual places upon this sum of money. This relationship can usually be expressed in terms of a mathematical formula. The appropriate rate is determined by the supply and demand for loanable funds.1/

In the long-run production period certain costs may not be repaid for a number of years. The interest charged on these unpaid costs increases at an increasing rate. This gives rise to the concept of compounding costs. The rate of interest charged for these costs need not be identical to the discount rate that the operator places on future income. This is because the operators' discounting of future income denotes an indifference curve while the interest charged on costs denotes an opportunity cost curve. For example, discounting of future income from a block of peaches can be influenced by the operators' desire to have a more stable income over time. Thus he might not want more than a certain percentage of his orchard in nonbearing trees.

Relationship Between a Stream of Net Revenue or Costs and Net Revenue or Costs in a Lump Sum

An understanding of the relationships between a stream of net revenue (costs) and net revenue (costs) received (paid) in a lump sum at different

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1/ A discussion of the appropriate discount rate is presented in a recent emperical study of time relationships by A. J. Coutu, et. al., An Economic Evaluation of Soil Conservation Practices, North Carolina Agr. Expt. Sta. Bul. 137, January 1959, Pp. 22-31.

points in time is necessary for the remainder of the analysis. Therefore, an attempt will be made to show these relationships both algebraically and graphically.

The process of converting a stream of net revenue (costs) into an equivalent lump sum payment will be discussed first. Assume that an individual expects to receive (pay) \$20.00 each year for the next 10 years. The effective discount rate (interest rate) is assumed to be 5 per cent per annum. This is the equivalent of an annuity of \$20.00 per year for 10 years. To convert these annual payments into their present value the formula for the present value of an annuity is used.[1/] By applying this formula the present value (PV) of the annuity of \$20.00 per year for 10 years is determined to be \$154.43. The amount of the annuity at the end of year 10 (Y) can be obtained by multiplying the present value by the formula for compound interest.[2/] This amount at the end of year 10 is \$251.56. Thus, an individual would be indifferent, assuming a 5 per cent discount and interest rate as to receiving \$20.00 at the end of each year for the next 10 years or receiving \$154.43 at the present time or receiving \$251.56 ten years from the present time.[3/]

1/ The formula for calculating the present value of an annuity is

$$PV = A\left[\frac{(1+i)^n-1}{i(1+i)^n}\right]$$

where A is the annuity and PV is the present value. When A = \$20.00, i = .05 and n = 10 years the present value (PV) equals \$154.43.

2/ The formula for calculating the value of an annuity at the end of year n is

$$Y = A\left[\frac{(1+i)^n-1}{i(1+i)^n}\right]\left[(1+i)^n\right] = A\left[\frac{(1+i)^n-1}{i}\right]$$

3/ An annuity is paid at the end of the year.

These relationships are presented graphically in Figure 15. The arrows indicate how the formulas will result in a movement from one point or points in time to another point or points in time.

The formulas for converting a lump sum into a stream of net revenue (costs) are the reciprocals of the formulas for converting a stream into a lump sum. Therefore, the amount at the end of year 10 can be converted into its present value and its amortized value (an annuity) by using the reciprocals of the formulas mentioned above.1/ These relationships and formulas are also presented in Figure 15.

1/ Assume that an individual expects to receive (pay) $251.56 ten years in the future. The present value of this sum is obtained by applying the formula for the present value to his sum or

$$PV = Y\left[\frac{1}{(1+i)^n}\right]$$

The present value is equal to $154.43 when i = .05. In order to obtain the stream of income the present value is multiplied by the amortization formula or

$$A = PV\left[\frac{i(1+i)^n}{(1+i)^n-1}\right]$$

Solving this, A = $20.00. This may also be expressed in terms of Y as

$$A = Y\left[\frac{1}{(1+i)^n}\right]\left[\frac{i(1+i)^n}{(1+i)^n-1}\right]\left[\frac{1}{(1+i)^n-1}\right]$$

This is the sinking fund formula. Unfortunately this formula is not presented in most of the books of mathematical tables.

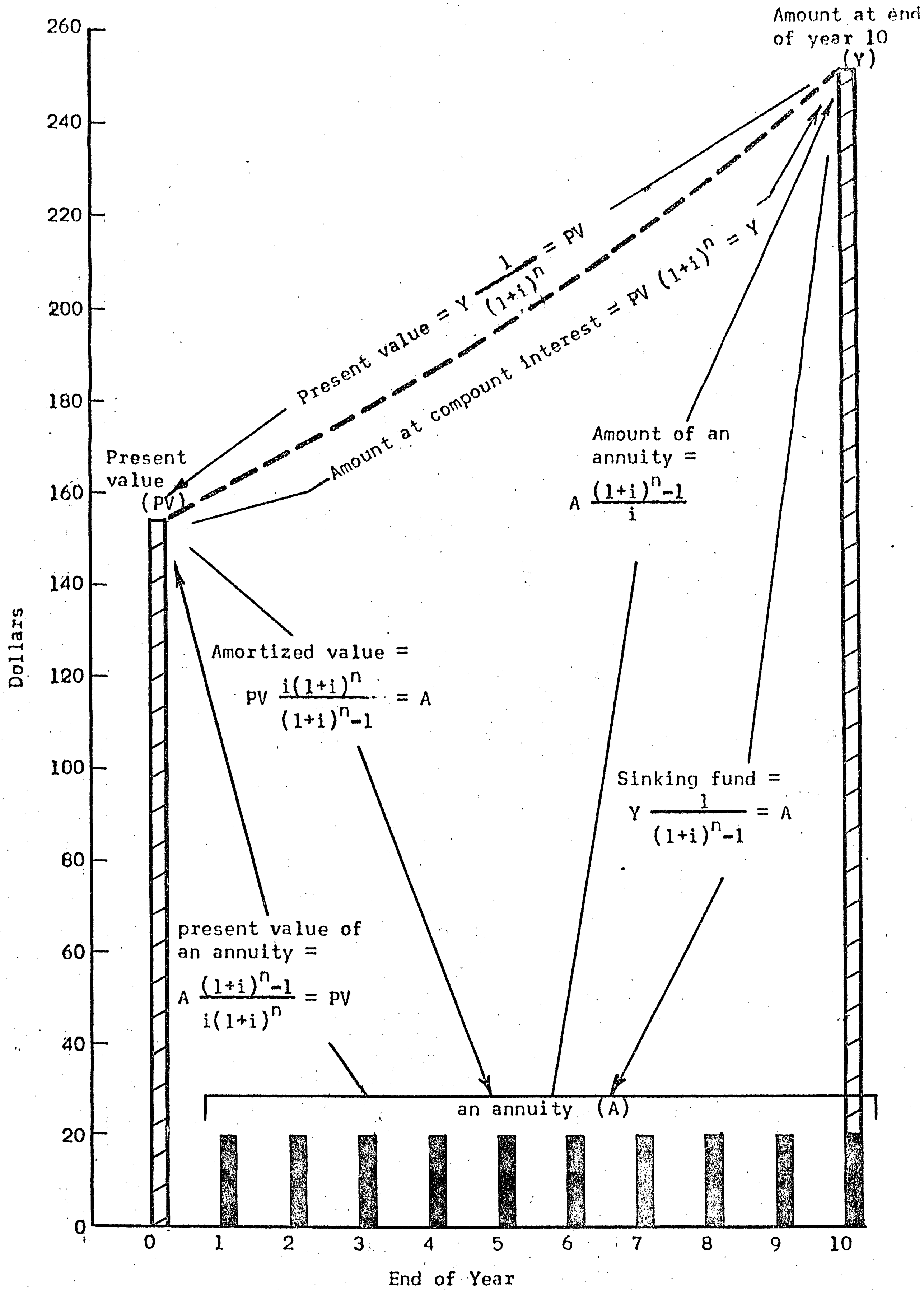

Figure 15. Relationships Between a Stream of Net Revenue or Costs and Net Revenue or Costs in a Lump Sum

The Principle for Optimum Replacement

It is necessary to determine which costs are relevant in determining whether to leave the cling peach orchard in or to replace it. It was implicitly stated in the previous discussion that for the present stand the initial cost of establishing the orchard is not relevant after these costs have been incurred. Thus the marginal net revenue (the adjusted annual net revenue) is the relevant figure to consider for the present orchard. However, for the following orchard all of the costs must be considered as relevant costs. Therefore, the accumulated net revenue column contains the relevant figures for the succeeding orchard (see Table 13). From the discussion of the simplified cling peach model it might appear that the maximum average net revenue (the adjusted accumulated net revenue ÷ the age of the tree) would indicate the optimum time to replace the orchard. However, the discussion on discounting indicates that this is not logically correct, providing the discount rate for time preference is not zero, because the marginal net revenue from the present orchard is not being compared with the maximum average net revenue from the following orchard at the same point in time. The marginal net revenue from the present orchard will be obtained within a year while the maximum average net revenue will not be obtained for 22 years.1/

In making the comparisons and analysis the common point in time will be the "present" time. Thus it is a problem of determining the present value of the costs and revenues incurred or received at various points in time.

1/ The maximum average net revenue of $180.00 occurs in year 22.

The data in Table 13 will be used to illustrate the method of obtaining comparable values. From the preceding discussion the net revenue equation for year n can be expressed as

(5) $NR_n = Y_n - a_n(i) - b_n - c_n$ where

Y_n = the gross revenue

a_n = the unpaid balance of the establishing cost at the beginning of year n or the end of year n-1

i = the interest rate charged on the unpaid balance

b_n = the operating or annual costs in year n

c_n = the planting costs in year n

The procedure expressed in Equation (5) was used to obtain the adjusted annual net revenues presented in Table 13. These net revenues are applicable to the present orchard. However, the present value of these net revenues must be obtained for the orchard that will follow. The present value of the net revenue in any year, i.e., year n, is obtained by multiplying the net revenue in that year by the formula for the present value ($\frac{1}{(1+r)^n}$, where r denotes the discount rate for time preference).1/ The present values are then accumulated to obtain a lump sum figure. The present values and the accumulated present value of the net revenue are presented in Table 14 for a 3 per cent and a 5 per cent discount rate for time preference. These figures are based upon the data in Table 13. To

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1/ $$\text{PV of } NR_n = \left[\frac{1}{(1+r)^n}\right]\left[Y_n - a_n(i) - b_n - c_n\right]$$

TABLE 14

Annual Net Revenue and Present Value and Amortized Present Value of Net Revenue Using a 3 Per Cent and a 5 Per Cent Discount Rate for Yield Anticipation 6, Late Maturing Varieties

Age of tree (years)	Annual (marginal) net revenue	Present value of the net revenue using a discount rate of:		Accumulated present value of the net revenue using a discount rate of: a/		Amortized present value of the net revenue using a discount rate of:	
		3 per cent	5 per cent	3 per cent	5 per cent	3 per cent	5 per cent
0	$-283	$-283	$-283	$- 283	$- 283	$-283	$-283
1	-216	-210	-206	- 493	- 489	-507	-513
2	-250	-235	-226	- 728	- 715	-380	-384
3	-227	-208	-196	- 936	- 911	-331	-335
4	-122	-108	-100	-1,044	-1,011	-281	-285
5	- 19	- 17	- 15	-1,061	-1,027	-232	-237
6	154	129	115	- 932	- 912	-172	-180
7	250	204	178	- 728	- 734	-117	-127
8	314	248	213	- 480	- 521	- 68	- 81
9	332	254	214	- 226	- 307	- 29	- 43
10	395	294	242	68	- 65	8	- 8
11	402	290	235	358	170	39	20
12	392	275	218	633	388	64	44
13	378	257	200	890	588	84	63
14	359	237	181	1,127	770	100	78
15	340	218	164	1,346	933	113	90
16	318	198	146	1,544	1,079	123	100
17	300	181	131	1,726	1,210	131	107
18	276	162	115	1,888	1,325	137	113
19	248	142	98	2,030	1,423	142	118
20	220	122	83	2,152	1,506	145	121
21	206	111	74	2,263	1,580	147	123
22	183	96	63	2,358	1,643	148	125
23	169	86	55	2,444	1,698	149	126
24	164	81	51	2,525	1,749	149.09	127
25	150	72	44	2,597	1,794	149.13	127.25
26	141	65	40	2,662	1,833	148.92	127.53
27	127	57	34	2,719	1,867	148	127.52

a/ These columns will not add up in all instances because of rounding errors.

compare the accumulated net revenue figures with the marginal net revenue from the present orchard it is necessary to convert the former to an equivalent stream of income.[1/] This is done by multiplying the accumulated present value of net revenue by the amortization formula $\left[\frac{r(1+r)^n}{(1+r)^n-1}\right]$.[2/] The amortized present values for a 3 per cent and a 5 per cent discount rate are presented in the last 2 columns in Table 14. These are the streams of net revenue that are equivalent to the accumulated present value of net revenues for the same number of years. For example in year 20, using a 5 per cent discount rate, the present value of the accumulated net revenue is $1,506.00 and the amortized present value is $121.00. The adjusted accumulated net revenue is $3,562.00 (see Table 13). The operator, assuming a 5 per cent discount rate for time preference, would be indifferent as to receiving a lump sum of $1,506.00 at the present time, $121.00 at the end of each year for 20 years (a total of $2,420.00) of $3,562.00 received over a 20 year period in the manner indicated in Table 13.[3/]

This stream of income from the following peach orchard can now be compared with the marginal net revenue from the present orchard. When the maximum expected stream of income from the following orchard becomes greater than the marginal net revenue from the present orchard then it becomes profitable to replace the present orchard. It is now possible to restate the principle of optimum enterprises with long production periods. The

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1/ The marginal net revenues could be converted to a lump sum figure. However, it is a less satisfactory approach whenever other types of comparisons are made.

2/ Amortized value in year n = $\left[\Sigma_n^o \frac{Y_n - a_n(i) - b_n - c_n}{(1+r)^n}\right]\left[\frac{r(1+r)^n}{(1+r)^n-1}\right]$

3/ The distribution of net revenue received over the 20 year period is obtained from the adjusted annual net revenue column. The net revenue is a negative value for the first 5 years.

<u>optimum time to replace is when the marginal net revenue from the present enterprise is equal to the highest amortized present value of expected net revenues from the enterprise immediately following.</u>[1/]

In the cling peach illustration the marginal net revenue becomes lower than the amortized net revenue from the following orchard in year 26 when the discount rate is 3 per cent and in year 27 when the discount rate is 5 per cent (Table 14). Thus in order to maximize net revenue over time the operator would replace the present block of trees at the end of 25 years if his discount rate for time preference is 3 per cent or at the end of 26 years if his discount rate is 5 per cent. This compares with replacing the trees at the end of 22 years when the maximum average net revenue criterion is used (when the discount rate for time preference is zero). The higher the operator's discount rate for time preference (the higher the value he places on present revenue) the longer the time period that he will keep the present trees before replacing them with another block of trees.

The amortized present values of net revenue using a discount rate of 3 per cent and 5 per cent presented in Table 14 were plotted (see Figure 16). These curves are rather flat from the 20th to the 30th years. The implication of this will be discussed in the next section. However, in most of the remainder of the analysis only the maximum amortized values will be used.

- -

1/ When the discount rate is zero this will result in the same answer that was obtained in the simplified model. This is because

$$\frac{1}{(1+r)^n} = 1 \text{ and } \lim_{r \to 0} \frac{r(1+r)^n}{(1+r)^n - 1} = \frac{1}{n} \text{ when the discount rate is zero.}$$

When the net revenue is multiplied by $\frac{1}{n}$ the average net revenue is obtained which is what was obtained in the simplified model.

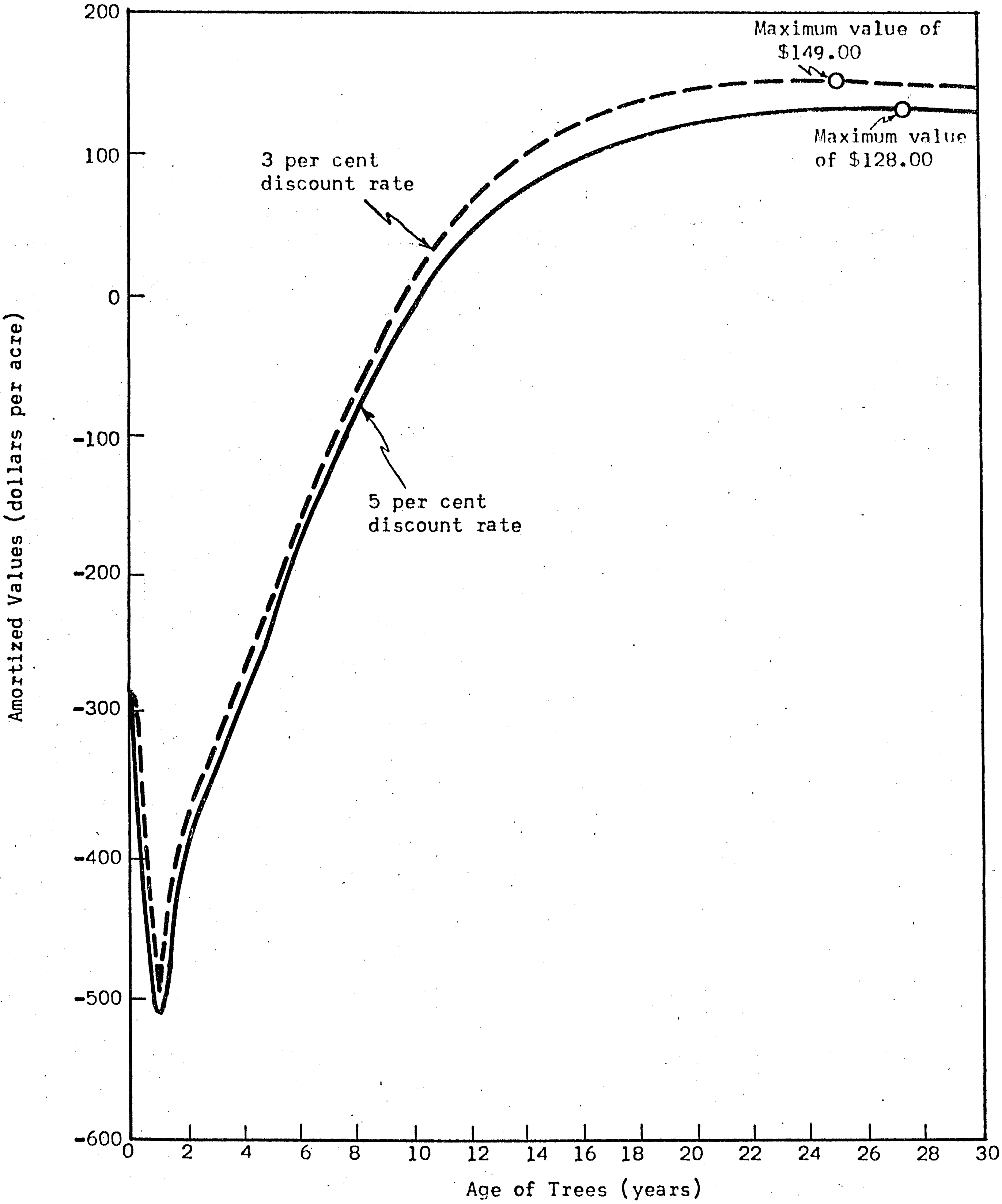

Figure 16. Amortized Present Values for Yield Anticipations Number 6 Using a 3 Per Cent and a 5 Per Cent Discount Rate, Late Maturing Varieties with the Price of Peaches at $60.00 per Ton

The maximum amortized values will be shown as a stream of net revenue in the remainder of the diagrams. Therefore, it will be presented as a straight line parallel to the axis of abscissas.

When the assumption that the orchard replacing the present orchard will have the same prices, costs and yields as the present orchard is relaxed it will be necessary to calculate a new set of amortized values. In the instance where costs or revenues are decreased or increased by a constant amount each year the amortized values will be lowered or raised by the amount of the constant value. This is because the addition or subtraction of a constant is the equivalent of an annuity.[1/] The marginal net revenue for the present stand would also be changed to the amount of the constant. Therefore, the optimum replacement pattern would not change.

In the instance where the costs or revenues are not changed by a constant amount the entire set of computations presented in Tables 20 and 21 must be repeated. For example, assume that the operator expected to obtain higher yields from the succeeding block of trees but did not expect the prices or costs to vary. Then the highest expected amortized present value must be calculated. This was done for a cling peach orchard with 1 to 2 tons per acre higher yield. The highest amortized value was approximately $219.00 per acre using a 5 per cent discount rate. If the operator expected the following orchard to yield such a return then he would replace the present orchard at the end of 20 years to maximize net revenue over time.

1/ If the constant amount is denoted by k the present value of k for n years is the equivalent of the present value of an annuity or

$$k \frac{(1+r)^n-1}{r(1+r)^n}$$

and the amortized value is

$$k \left[\frac{(1+r)^n-1}{r(1+r)^n}\right] \left[\frac{r(1+r)^n}{(1+r)^n-1}\right] = k$$

VII. OPTIMUM REPLACEMENT

The optimum replacement patterns for the 16 representative (anticipated) yield curves constructed in Section IV will be determined in this section. In the first part of the analysis the price received by farmers for cling peaches will be assumed to be $60.00 per ton. The costs of production will be those presented in Section V.1/ The effects of higher and lower prices received for cling peaches will then be investigated. The effects of increasing and decreasing the costs will also be investigated.

Although a distinction between early and late varieties has been made, farmers anticipations with respect to certain blocks of a late variety will more nearly parallel the ancitipations presented for the early varieties rather than the late varieties and vice versa. Thus, rather than having 7 yield anticipations for the early varieties and 9 yield anticipations for the late varieties there are 16 yield anticipated yield curves that may be applicable for both the early and the late varieties.

Optimum Replacement, Expected Yields, Costs and Revenues

The net revenues, adjusted for interest on the unpaid balance of the establishing costs, were calculated for the 16 anticipated yield curves. In order to have the relevant information together the yields, obtained from Figures 10 and 11, are presented in Tables 15 and 16. The associated net revenues are presented in Figures 17 and 18. The maximum amortized present values, using a 5 per cent discount rate for time preference, are also presented in Figures 17 and 18.

1/ A summary of the costs that do not vary with output is presented in Appendix B, Table 1. A summary of the pre-harvest variable costs is presented in Appendix B, Tables 2 through 13 by age of tree.

TABLE 15

Yield Anticipations by Age of Tree for Early Maturing Varieties, Tons per Acre

Age of tree (years)	Anticipations with respect to yields (tons per acre) for anticipations number:						
	1	2	3	4	5	6	7
0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0
3	0	0	1.0	1.0	2.0	2.0	2.0
4	3.0	3.0	4.0	4.0	6.0	6.0	6.0
5	5.0	5.0	8.0	8.0	9.5	9.5	9.5
6	8.5	8.5	12.8	12.8	15.1	16.0	16.0
7	10.5	10.9	14.5	14.7	16.4	18.0	18.4
8	11.5	12.7	15.0	15.8	17.1	18.8	19.3
9	11.8	14.0	15.0	17.0	17.7	19.3	21.0
10	12.0	14.8	15.0	17.5	18.0	19.5	21.7
11	12.1	14.9	15.0	17.8	18.0	19.6	22.0
12	12.1	14.9	15.0	17.9	18.0	19.6	22.0
13	12.1	14.8	14.9	17.8	18.0	19.5	21.8
14	12.1	14.6	14.9	17.5	18.0	19.4	21.5
15	12.1	14.3	14.8	17.2	18.0	19.3	21.4
16	12.1	13.9	14.8	16.8	18.0	19.2	21.1
17	12.1	13.7	14.7	16.5	18.0	19.0	20.7
18	12.0	13.4	14.5	16.2	18.0	18.9	20.4
19	11.8	13.0	14.4	15.8	18.0	18.6	20.0
20	11.6	12.5	14.2	15.4	18.0	18.4	19.6
21	11.3	12.0	14.0	15.0	18.0	18.2	19.4
22	11.0	11.5	13.8	14.5	17.9	17.9	19.0
23	10.7	11.0	13.6	14.0	17.7	17.7	18.6
24	10.4	10.6	13.4	13.6	17.5	17.5	18.3
25	10.0	10.2	13.0	13.1	17.2	17.2	17.9
26	9.5	9.6	12.8	12.8	17.0	17.0	17.5
27	9.1	9.1	12.5	12.5	16.8	16.8	17.2
28	8.8	8.8	12.1	12.1	16.5	16.5	16.8
29	8.4	8.4	11.7	11.7	16.1	16.1	16.4
30	8.0	8.0	11.3	11.3	15.7	15.7	15.9

TABLE 16

Yield Anticipations by Age of Tree for Late Maturing Varieties, Tons per Acre

Age of trees (years)	Anticipations with respect to yields (tons per acre) for anticipation number:								
	1	2	3	4	5	6	7	8	9
0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0
3	0	0	0	1.0	1.0	1.0	2.0	2.0	2.0
4	4.5	4.5	4.5	5.5	5.5	5.5	6.5	6.5	6.5
5	6.0	6.0	6.0	8.5	8.5	8.5	12.0	12.0	12.0
6	9.0	9.0	9.0	14.0	14.0	14.0	17.3	17.3	17.3
7	11.0	11.0	11.0	15.5	16.2	16.2	19.0	19.0	20.0
8	11.9	13.0	13.0	16.0	17.1	17.8	19.6	20.0	21.4
9	12.0	13.8	14.3	16.0	17.4	18.7	20.0	20.5	22.4
10	12.0	14.0	14.9	16.0	17.5	19.2	20.0	21.0	23.1
11	12.0	14.0	15.0	16.0	17.5	19.4	20.0	21.0	23.7
12	12.0	14.0	15.0	16.0	17.5	19.3	20.0	21.0	24.0
13	12.0	14.0	14.9	16.0	17.4	19.0	20.0	21.0	24.0
14	12.0	14.0	14.5	16.0	17.2	18.6	20.0	21.0	23.9
15	12.0	14.0	14.1	16.0	17.0	18.2	20.0	20.9	23.5
16	12.0	13.9	13.9	16.0	16.7	17.7	20.0	20.5	22.6
17	12.0	13.6	13.6	16.0	16.4	17.3	20.0	20.1	22.0
18	12.0	13.4	13.4	15.9	16.2	16.8	19.8	19.8	21.5
19	12.0	13.2	13.2	15.8	15.8	16.2	19.4	19.4	21.0
20	12.0	12.8	12.8	15.6	15.6	15.6	19.0	19.0	20.5
21	12.0	12.5	12.5	15.3	15.3	15.3	18.6	18.6	19.9
22	12.0	12.2	12.2	14.8	14.8	14.8	18.1	18.1	19.4
23	11.9	11.9	11.9	14.5	14.5	14.5	17.8	17.8	18.7
24	11.5	11.5	11.5	14.4	14.4	14.4	17.5	17.5	18.2
25	11.0	11.0	11.0	14.1	14.1	14.1	17.1	17.1	17.6
26	10.6	10.6	10.6	13.9	13.9	13.9	16.8	16.8	17.2
27	10.2	10.2	10.2	13.6	13.6	13.6	16.5	16.5	16.7
28	10.0	10.0	10.0	13.4	13.4	13.4	16.0	16.0	16.2
29	9.5	9.5	9.5	13.1	13.1	13.1	15.7	15.7	15.8
30	9.0	9.0	9.0	13.0	13.0	13.0	15.5	15.5	15.5

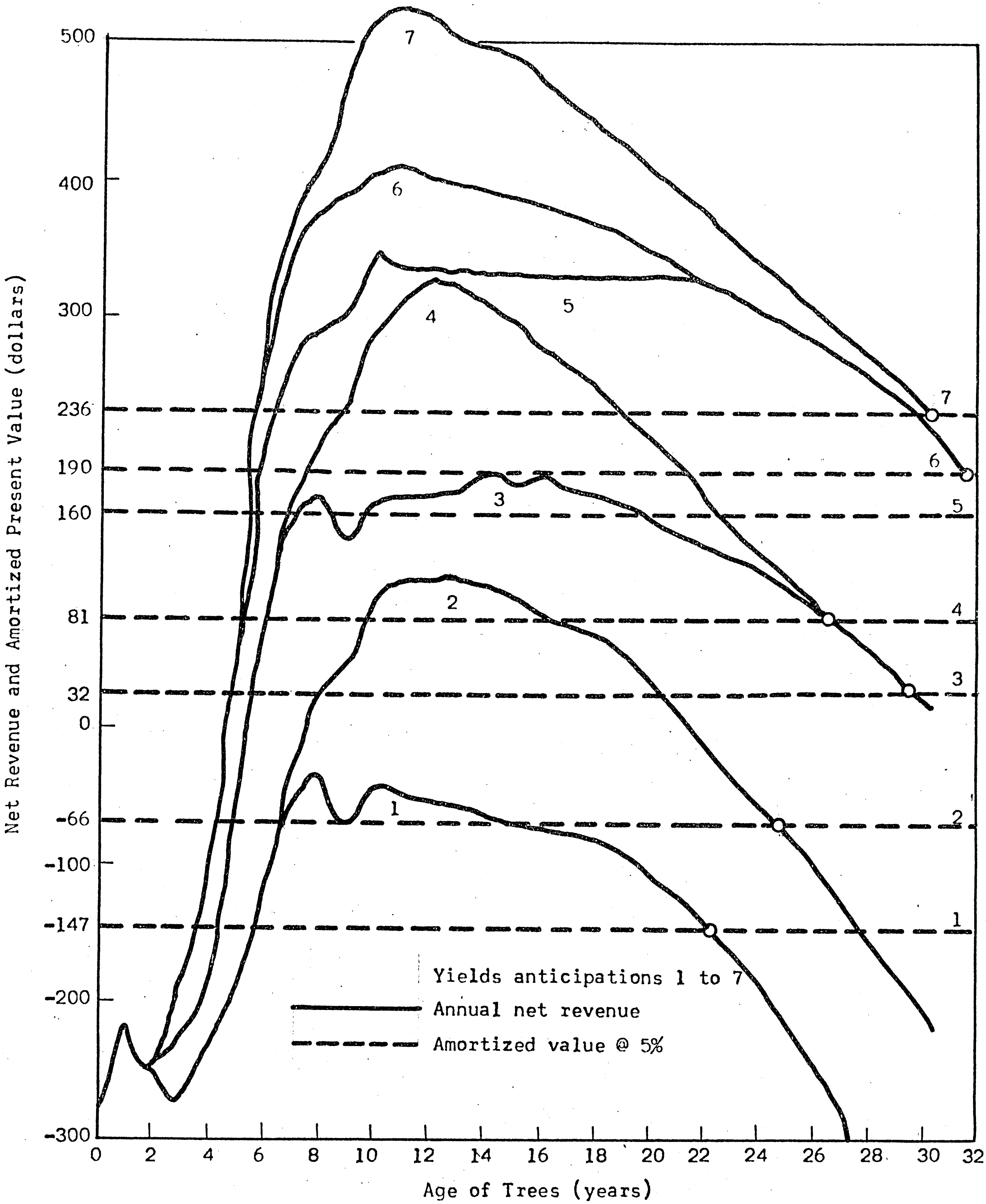

Figure 17. Annual Net Revenue and Maximum Amortized Present Value of Net Revenue Using a 5 Per Cent Discount Rate by Yield Anticipations with the Price of Peaches at $60.00 per Ton, Early Maturing Varieties

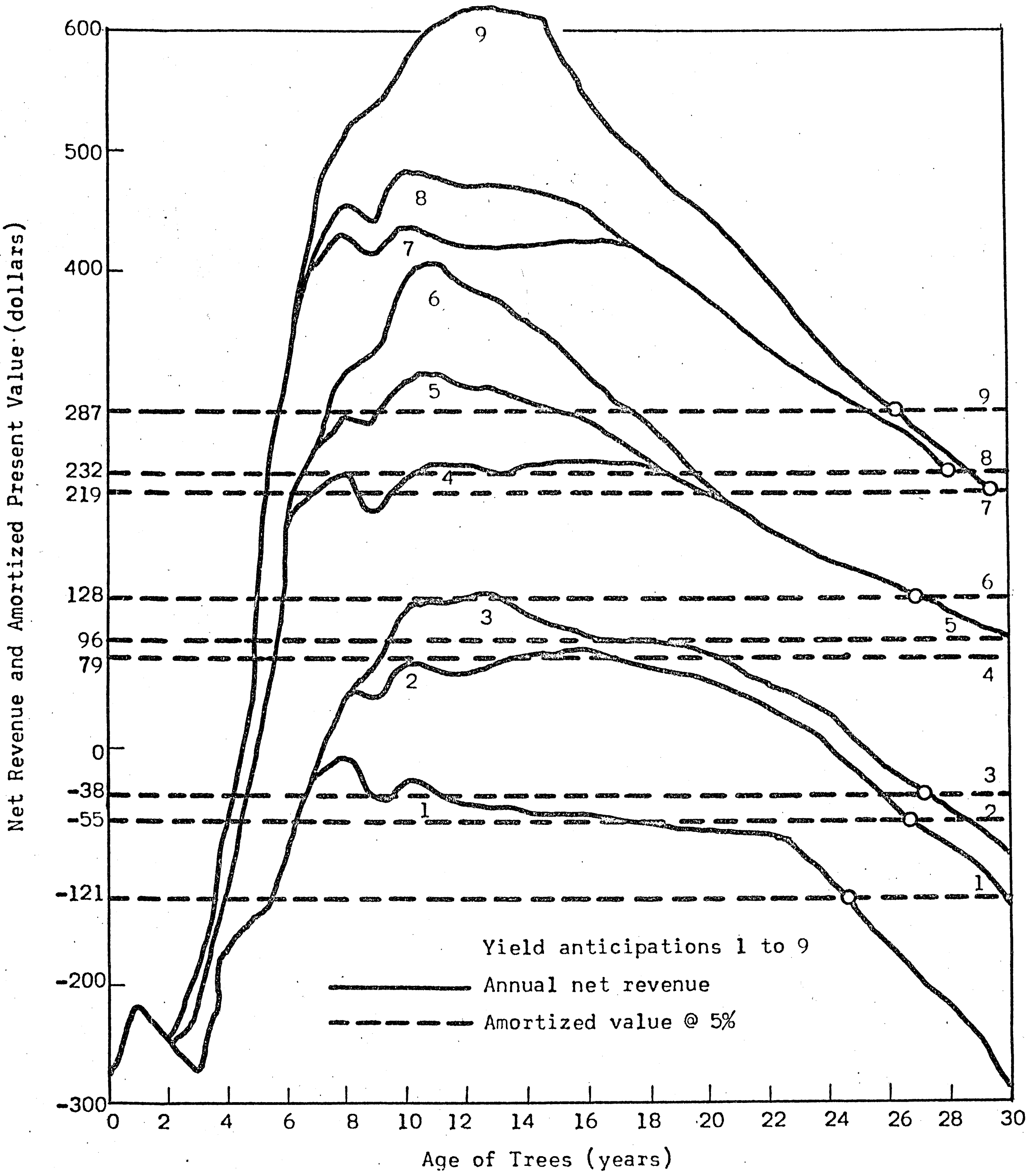

Figure 18. Annual Net Revenue and Maximum Amortized Present Value of Net Revenue Using a 5 Per Cent Discount Rate by Yield Anticipations with the Price of Peaches at $60.00 per Ton, Late Maturing Varieties

The point of intersection of the net revenue curve with the highest amortized value indicates the point of equality between the marginal net revenue and the amortized value. In Figure 17, for example, assumes that the operators anticipations with respect to yields, prices and costs will result in net revenue curve number 3. If his anticipations with respect to net revenue are identical for the present orchard and the succeeding orchard he would replace the present orchard at the end of 29 years (assuming his discount rate for time preference is 5 per cent). This is because the marginal net revenue becomes lower than the highest amortized value in year 30. The points at which the anticipated net revenues from the present trees are equal to the highest amortized values for the succeeding trees with identical anticipated net revenues are indicated by a small circle on the figures. However, if he expects the succeeding orchard to result in a net revenue similar to number 4 he would replace the present orchard at the end of year 26 (assuming a 5 per cent discount rate). This is because the expected marginal net revenue from the present orchard (number 3) becomes lower than the expected highest amortized value from the succeeding orchard (number 4). This information in Figures 17 and 18 has been summarized in Table 17 for all possible combinations of anticipations with respect to net revenue.

The maximum amortized values associated with yield anticipations 1 and 2 for the early varieties and 1, 2 and 3 for the late varieties are negative values.1/ These negative values indicate that it would be unprofitable to

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1/ These are the maximum amortized values in the sense that they are the smallest negative values.

TABLE 17

End of Year in Which the Present Trees Should be Replaced Using a 5 Per Cent Discount Rate, by Yield Anticipations and Maturity Date

Yield anticipations for succeeding tree	Yield anticipations present trees								
	1	2	3	4	5	6	7	8	9
	early maturing varieties								
1 and 2	a/	a/	a/	a/	a/	a/	a/	--	--
3	b/	20	29	29	30+	30+	30+	--	--
4	b/	16 c/	26	26	30+	30+	30+	--	--
5	b/	b/	19	22	30+	30+	30+	--	--
6	b/	b/	b/	21	30+	30+	30+	--	--
7	b/	b/	b/	19	29	29	30		
	late maturing varieties								
1, 2 and 3	a/	a/	a/	a/	a/	a/	a/	a/	a/
4	b/	b/	19	30+	30+	30+	30+	30+	30+
5	b/	b/	17	30	30	30	30+	30+	30+
6	b/	b/	b/	26	26	26	30+	30+	30+
7	b/	b/	b/	20	20	20	29	29	29
8	b/	b/	b/	18	18	19	28	28	28
9	b/	b/	b/	b/	14	17	25	25	26

a/ The highest amortized present value of the succeeding trees is negative. Therefore the operator would not replant.

b/ The present trees should be replaced as soon as possible.

c/ This will be the maximum. If the operator has not pulled the present trees by the end of the 6th year he will probably not replace them until the end of the year indicated.

plant an orchard with these anticipated net revenues. The orchard would be unable to yield a sufficient revenue to repay the cost of establishing as the unpaid balance of the establishing cost is always negative. The negative amortized values have no relevance in determining the optimum time to replace the present trees because an operator would be irrational to produce when the marginal net revenue is less than zero. The annual net revenue from orchards with yields similar to anticipations 1, for both the early and the late maturing varieties, is always negative. Therefore, it would be profitable to pull these orchards as soon as possible. However, the annual net revenue is positive in some of the years for the other yield anticipations with negative amortized values. In order to determine whether or not to replace these trees immediately two factors must be considered. These are (1) the year in which the decision is made and (2) the alternative available. For example, if an operator had a 5 year old orchard with net revenue anticipations similar to number 2 for the early maturing variety and his net revenue anticipations for the next orchard were similar to number 3, would he replace the present orchard immediately or would he keep it until the end of year 20? At the end of year 5, when the operator is making this decision, only the cost that he will have to meet and the revenues that he will receive in the future are important. The previous costs and revenues are not considered in making this decision with one exception. This exception is the interest on the unpaid balance of the establishing costs which will have to be paid in the future which is partly a function of the costs and revenues incurred in the past. Thus, in order to make the decision concerning immediate replacement the end of year 5 would now be considered as year zero. The highest amortized value, starting at the end of year 5, is approximately $50.00 when a 5 per cent discount rate is used. This is higher than the $32.00 maximum amortized value for the next orchard (assuming its net revenue anticipations were similar to that of number 3). Thus the stream of anticipated net revenue from the present orchard starting at the end of year 5 is greater than the stream of anticipated income from the succeeding orchard starting at year zero although the latter's annual net revenue is higher. However, if the highest amortized value from the succeeding orchard had been greater than $50.00 then it would have been profitable, in terms of maximizing net revenue over time, to have replaced the present orchard at the end of year 5.

The above may explain why orchardists do not in many instances immediately replace a relatively low producing orchard. It may require 4 or 5 or even more years to determine whether or not the orchard will be a relatively low producer. By this time the operator will have incurred the largest part of the investment required to bring the orchard into full production. Because of this uncertainty with respect to the yields in the early years only the section of the net revenue curve that is decreasing (when the annual or marginal net revenue is decreasing) is important in most instances in determining the optimum time to replace.

The Effect of Increasing and Decreasing the Price Received for Cling Peaches

What effect does a $5.00 per ton decrease in the price received for cling peaches have upon the net revenue, the amortized present value of net revenue and consequently the optimum replacement time? This effect is presented graphically for yield anticipations 3 (early varieties) and for yield anticipations 6 (late varieties) in Figures 19 and 20, respectively.1/

A $5.00 per ton decrease in the price has a drastic effect upon net revenue. This is because a change in the price received is assumed to have no effects upon the cost of production. This assumption is rather realistic in the short-run although in the longer period of time the orchardists may expand the size of his operation, produce crops other than cling peaches, etc. This of course would alter the costs of production. In the illustrations used the amortized present value of net revenue would be decreased by approximately $70.00 per acre. In the instance where the orchardist has a yield anticipation for early varieties similar to number 3 it would be unprofitable to replant the orchard if the yield anticipations did not increase and the price anticipations were $55.00 per ton.

Although the changes in net revenues and amortized values changed quite drastically the optimum age to replace the trees remained approximately the same. Thus small changes in the price received apparently has little effect upon the time to replace trees.

1/ The Figures presented below are based upon the data presented in Appendix C, Tables 3 and 7.

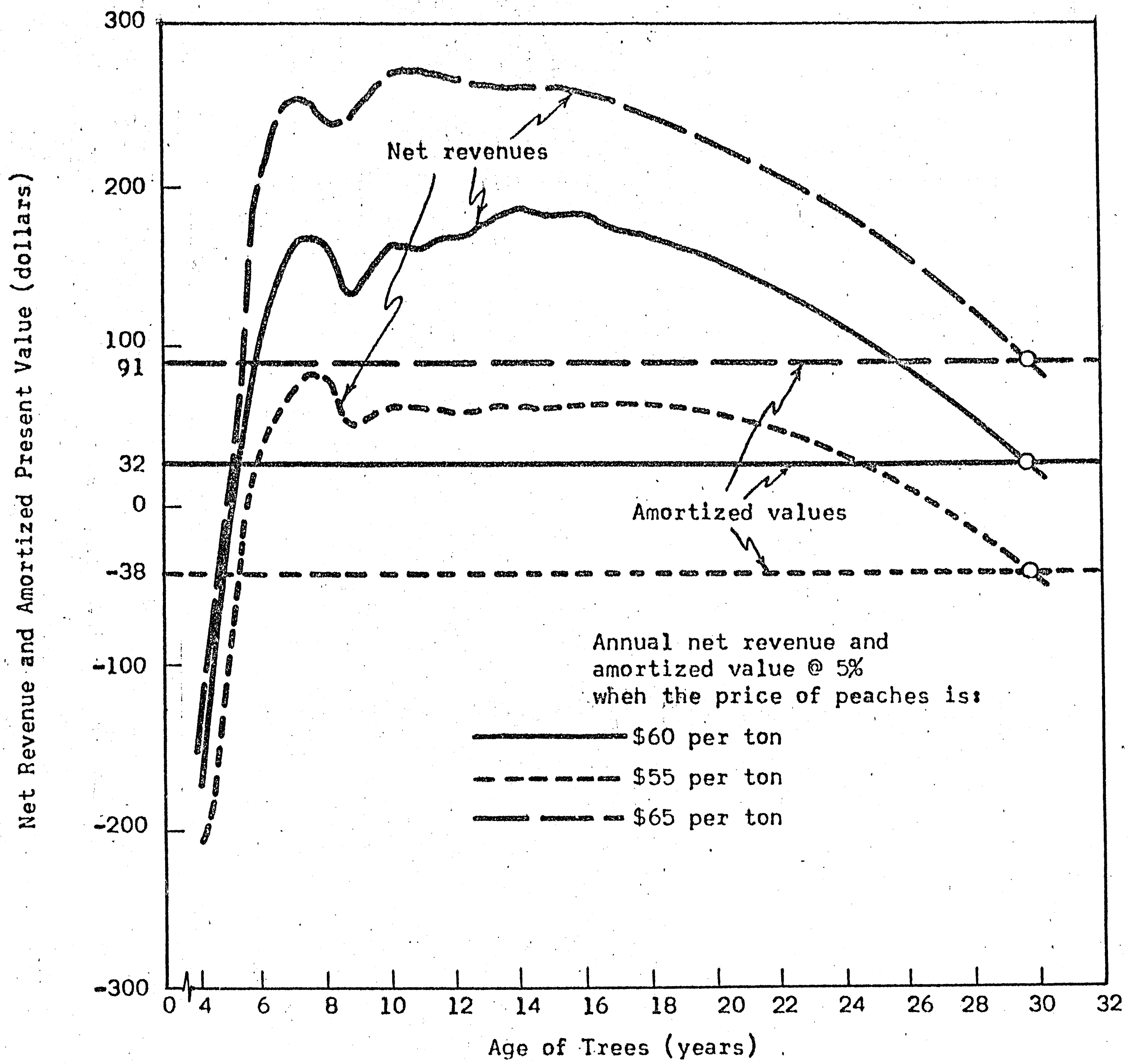

Figure 19. The Effects on Net Revenue and Maximum Amortized Present Values on Net Revenue of Changing the Price of Peaches by $5.00 Per Ton, Yield Anticipations 3, Early Maturing Varieties

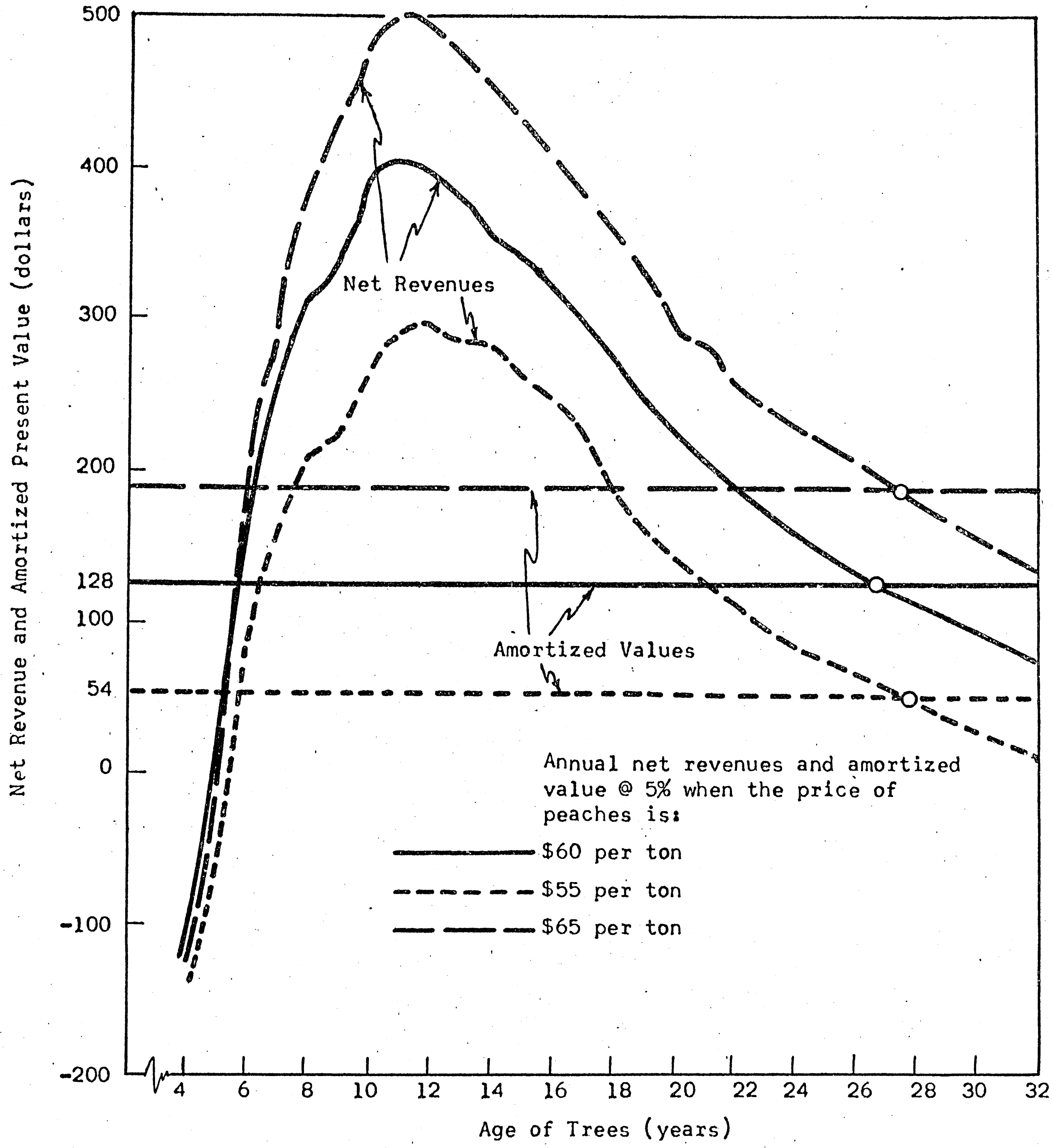

Figure 20. The Effects on Net Revenue and Maximum Amortized Present Values of Net Revenue of Changing the Price of Peaches by $5.00 per Ton, Yield Anticipations 6, Late Maturing Varieties

The effects of a $5.00 per ton increase in the price received for cling peaches are also shown in Figures 19 and 20 for the same yield anticipations. These figures indicate that the results are similar to those obtained by a $5.00 per ton decrease in price except that the net revenues and amortized values move in the opposite direction.[1/]

How does a change in the price received for cling peaches effect the orchardist as compared to a change in anticipated yields? The answer to this question obviously is partly dependent upon the magnitude of the changes in prices and yields. However, orchardists may be affected differently. For example, assume that there are 2 orchardists, orchardist A and orchardist B. The anticipated yield for the present trees are number 3 (early varieties) for orchardist A and number 4 (late varieties) for the orchardist B. Also assume that it is about time to replace the present trees. Although both orchardists are interested in higher yields and prices the changes in yields and prices will affect the two orchardists differently. If orchardist A expects the following orchard to have yields similar to anticipations number 5 (early varieties) and orchardist B expects the following orchard to have yields similar to anticipations number 6 (late varieties) what will be the effect of a change in yields and a change in price? These have been summarized below as follows:

1/ The effects of a $5.00 per ton increase and decrease in the price received for cling peaches were also investigated for other yield anticipations and for a 3 per cent discount rate for time preference (see Appendix C, Tables 3 through 8). This information substantiates the findings presented above that small changes in the price received for cling peaches has little effect upon the optimum replacement date.

ORCHARDIST A

	Present orchard	Following orchard
Yield anticipations (early varieties)	No. 3	No. 5
Highest amortized value at:		
$55.00 per ton	$-38.00	$ 89.00
$60.00 per ton	32.00	160.00
$65.00 per ton	91.00	233.00

ORCHARDIST B

	Present orchard	Following orchard
Yield anticipations (late varieties)	No. 4	No. 6
Highest amortized value at:		
$55.00 per ton	$ 16.00	$ 54.00
$60.00 per ton	80.00	128.00
$65.00 per ton	142.00	194.00

An increase in yields, from anticipations number 3 to number 5, has approximately the same effect on the net revenue for orchardist A as a $10.00 per ton increase in price. An increase in yields, from anticipations number 4 to number 6, has less effect upon the net revenue for orchardist B than does a $5.00 per ton increase in price. Thus the price received for cling peaches has a relatively larger effect upon the net revenue of orchardist B than orchardist A. If a decrease in the price is anticipated in the near future this would probably result in orchardist B delaying the replacement of his present orchard for a longer period of time than orchardist A. This is because the alternative, in terms of net revenue, is relatively better for the latter with respect to the succeeding orchard.

Although it has not been pursued in great detail it is evident that the effects of changes in anticipated prices can be investigated without too much difficulty. The analysis indicates that the level of prices has little effect upon the optimum age at which to replace trees providing the present and future anticipations with respect to price are the same. Generally, when the future anticipations with respect to price are higher (lower) than the present anticipations the orchardists will replace their trees earlier (later). One exception is that if the price decreases so that the present orchard has negative net revenues the orchardist may replace the trees earlier than if the price had not decreased.

The Effect of Increasing and Decreasing Costs

It was pointed out in an earlier section that when costs are increased or decreased by a constant amount each year, not taking into account the effect on the unpaid balance of the establishing costs, the net revenue and amortized values are also increased or decreased by this constant amount. However, when the interest on the unpaid balance is taken into account a constant increase or decrease in costs will not result in a constant increase or decrease in the net revenue and consequently the amortized values. When costs are decreased the interest on the unpaid balance is decreased and vice versa. This in turn will affect the net revenue.

The effects on net revenues and amortized values of a $50.00 per year increase or decrease in costs are presented in Figures 21 and 22 for yield anticipations number 3 (early varieties) and number 8 (late variaties), respectively. It is evident from these diagrams that a $50.00 per year

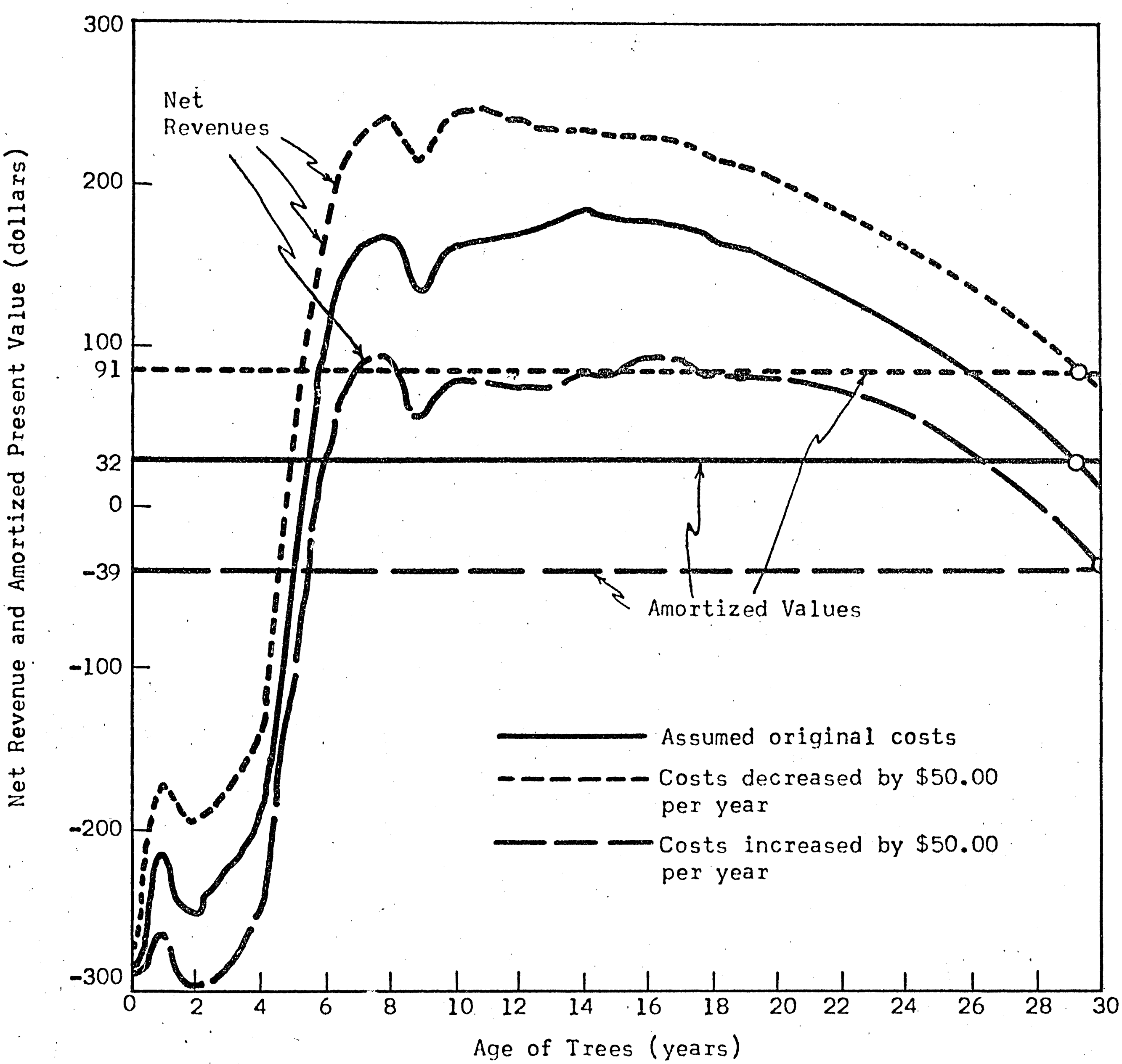

Figure 21. The Effects on Net Revenue and Maximum Amortized Present Values of Net Revenue of Increasing and Decreasing Costs by $50.00 per Year, Yield Anticipations 3, Early Maturing Varieties

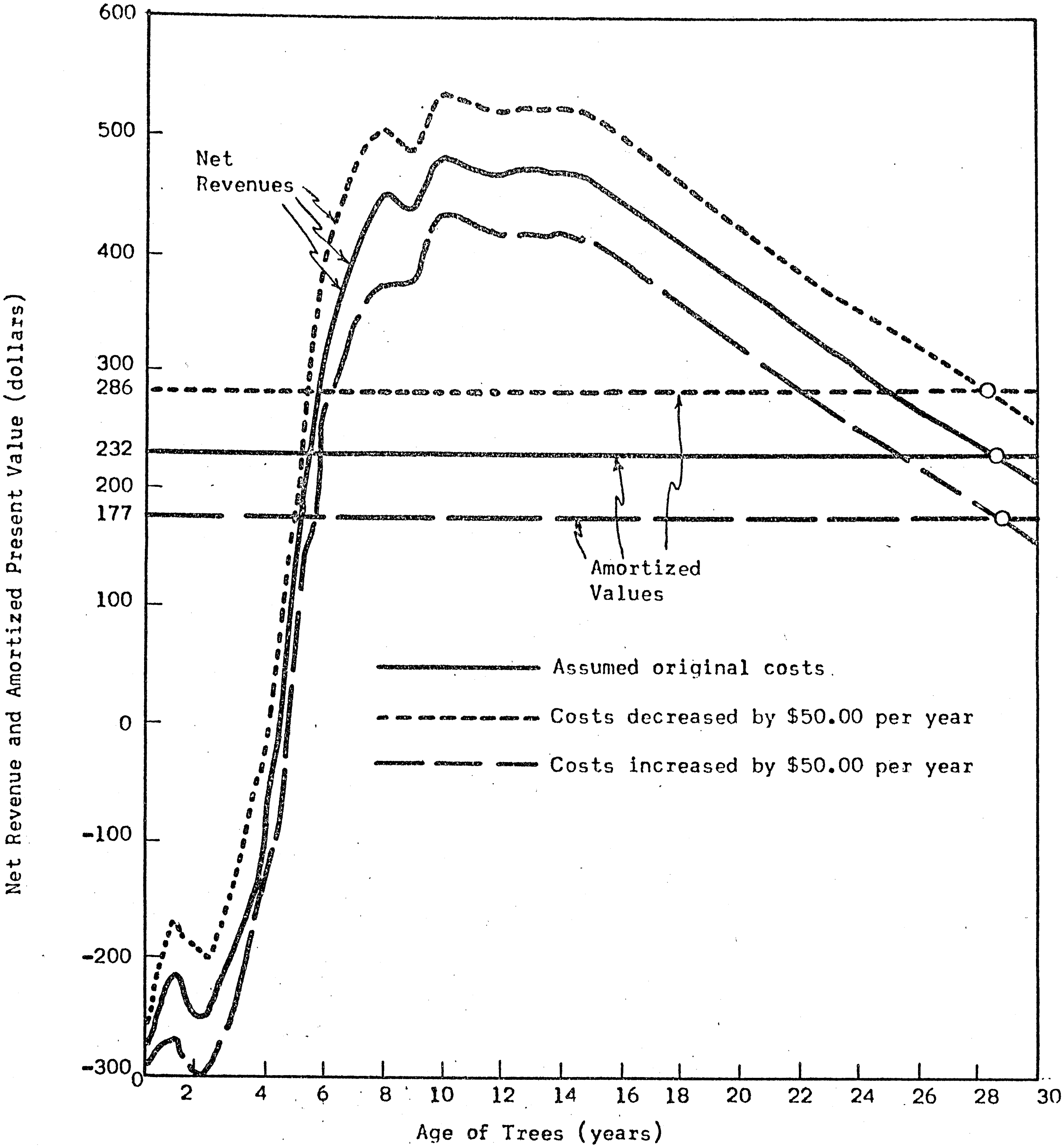

Figure 22. The Effects on Net Revenue and Maximum Amortized Present Values of Net Revenue of Increasing and Decreasing Costs by $50.00 per Year, Yield Anticipations 8, Late Maturing Varieties

change in costs results in a larger than $50.00 per year change in the amortized present values of net revenue. It is also evident, upon closer inspection, that once the unpaid balance of the establishing costs is reduced to zero the $50.00 change in cost results in only a $50.00 difference in annual net revenue. Yield anticipations numbers 3 and 8 depict a wide range in yield anticipations. On the one end is yield anticipations number 3 where the $50.00 change in annual costs causes the optimum replacement date to shift by one year. On the other end is yield anticipations number 8 where the $50.00 change does not affect the optimum replacement date. The optimum replacement date of the lower yielding trees will be affected more by changes in costs because of the relatively greater effect on the unpaid balance of the establishing costs. It appears that in most instances that the amount of a constant annual increase or decrease in costs will approximate the amount of the increase or decrease in the maximum amortized value and the annual net revenue.1/ Thus the effect upon the optimum replacement age will be small for changes that result in a constant dollar increase or decrease in costs.

Throughout this analysis it has been assumed that the pre-harvest variable costs have been associated with age rather than yields. Thus the pre-harvest variable costs for any one year have not changed as yields were increased or decreased. Logically it might be expected that these costs would vary somewhat with yields. Therefore the effects of a 10 per cent reduction and a 10 per cent increase in pre-harvest variable costs

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1/ A decrease of $50.00 per year in costs was investigated for 6 anticipated yield curves (see Appendix C, Tables 3 through 8). The results are consistant with the findings reported above.

were investigated for relatively low producing trees and relatively high producing trees, respectively. The 10 per cent reduction in these costs for yield anticipated number 3 (early varieties) resulted in an increase of $30.00 in the maximum amortized value as compared to a $34.00 per year increase in the net revenue after the establishing costs were repaid (Figure 23). The 10 per cent increase in these costs for yield anticipations number 8 (late varieties) resulted in a decrease of $27.00 in the maximum amortized value as compared to a $34.00 per year decrease in the net revenue after the establishing costs were repaid (Figure 24). Thus changes as large as 10 per cent in the pre-harvest variable costs would have little effect upon the optimum replacement age. If it were assumed that these costs increase as anticipated yields increase the lower producing trees would be slightly more profitable but the optimum replacement age would not, in most instances, be changed by more than one year.

Each orchard operatinn has a different set of costs. The costs used in this investigation are representative costs and therefore are applicable to only a few of cling peach orchards in California. However, this does not make the results of the analysis concerning the optimum replacement pattern invalid for most of the operators. It was demonstrated that the major effect of increasing or decreasing the annual costs by a constant amount was to increase or decrease the annual net revenue and thus the stream of revenue over time by an approximately equal amount. Thus an orchardist with a different set of fixed costs would replace his trees at approximately the same time as the analysis indicates for similar price, yield and discount rates in order to maximize net revenue over time. Some

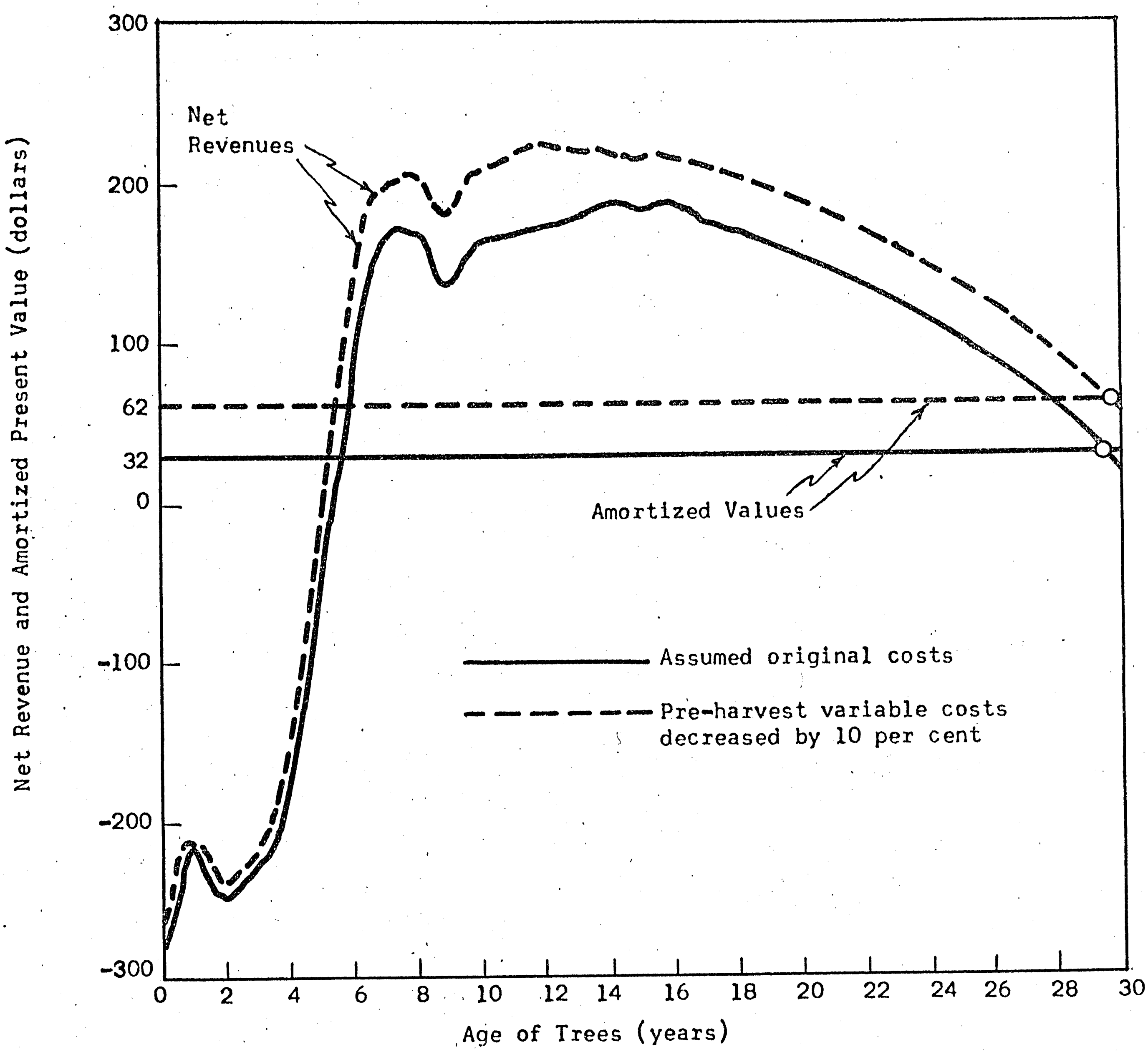

Figure 23. The Effects on Net Revenue and Maximum Amortized Present Values of Net Revenue of Decreasing the Pre-harvest Variable Costs by 10 Per Cent, Yield Anticipations 3, Early Maturing Varieties.

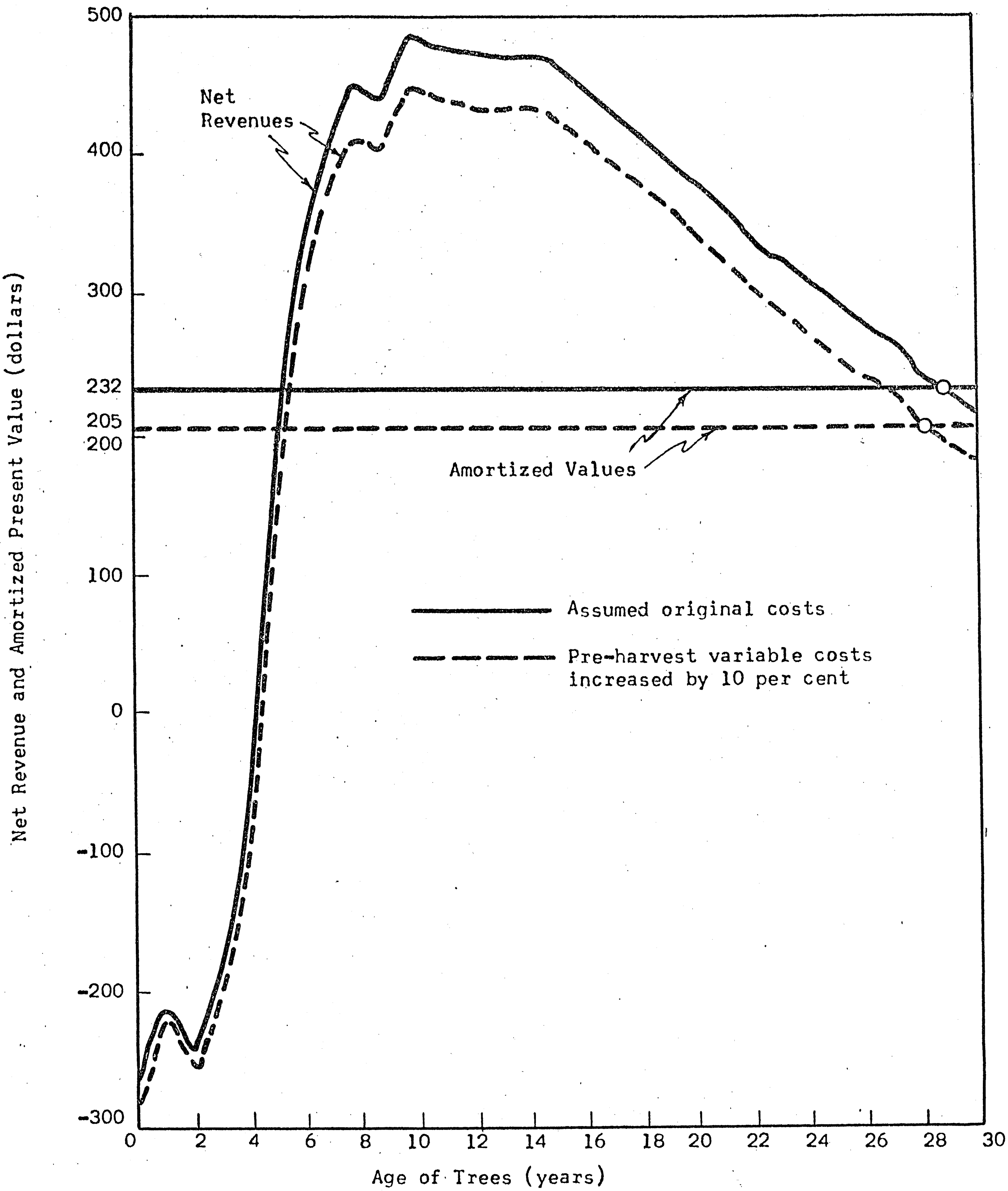

Figure 24. The Effects on Net Revenue and Maximum Amortized Present Values of Net Revenue of Increasing the Pre-harvest Variable Costs by 10 Per Cent, Yield Anticipations 8, Late Maturing Varieties

of the major variable costs, i.e., pruning, thinning and spraying are constant or relatively constant after the 7th year. Thus an increase or decrease in these costs would approximate a change in the annual costs of a constant amount. It was also demonstrated that if the pre-harvest variable costs increase as yield anticipations increase the optimum replacement age would not be affected very much. Another major variable cost, the harvesting cost, is a function of the yield. Therefore, changes in the harvesting cost would have the same effect as a change in the price received for cling peaches. As was demonstrated earlier this had little effect upon the optimum replacement date.

The conclusion can be reached that the optimum replacement patterns presented are applicable to a large number of cling peach orchardists in California providing their discount rates for time preference are not much greater than that considered in this analysis. The exact effect of an increase in the discount rate can not be determined without further analysis. Undoubtedly the different yield anticipations will not all be affected to the same extent and the optimum time to replace trees will be extended.

The Effect of Changes in Yield Curves for Older Trees

The information on yields for trees 20 years old or older was not very adequate. The yields that were assumed may be held in suspect by a number of orchardists in regard to their particular block of peaches. In order to make the analysis more usable it is necessary to determine the effects of changing the assumptions with respect to yields for trees that are 20 or more years of age.

As the two values that determine the optimum replacement date are the amortized value and the marginal or annual net revenue it is necessary to examine the effects on these two values. The maximum amortized values and the amortized present values in year 20 and year 24 are presented in Table 18.[1/] More than 2/3 of the amortized present values are within $16.00 of their maximum by the end of year 20 and, with the exception of yield anticipations 5 for the early varieties, all are within $23.00 by the end of year 20. By the end of year 24 more than 2/3 of the amortized values are within $4.00 of their maximum. This indicates that the slopes of the amortization curves are relatively flat after the trees are 20 years old or older (see Figure 16).

Because of the relatively small differences in costs, other than harvesting costs, after the trees are 16 years old and older it is possible to discuss the effects of changes in yields in terms of tons or dollars per ton. The data indicate that a 1/2 ton change in yield results in a $23.33 change in the net revenue for these older trees (Table 19).[2/] Thus, in terms of tons per acre, the amortized present value at the end of year 20 is within 1/2 ton of the maximum amortized value for all yield anticipations except one. More than 2/3 of the amortized present values at the end of 20 years are within 1/3 of a ton of the maximum. This is all the more important when it is kept in mind that what happens to yields after any specified

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1/ A 3 per cent as well as the 5 per cent discount rate for time preference was included in order to give a little more breadth to the investigation of the effects of changes in yields.

2/ This assumes that the orchardist receives $60.00 per ton for cling peaches.

TABLE 18

Maximum Amortized Values and Amortized Values in Year 20 and Year 24
by Maturity Date Discount Rate and Yield Anticipations
with the Price of Peaches at $60.00 per Ton

Anticipations	Early maturing varieties		Late maturing varieties	
	Discount rate at:		Discount rate at:	
	3%	5%	3%	5%
	dollars		dollars	
Yield anticipation 3				
Maximum amortized value	50	32	--	--
Amortized value, year 20	35	16	--	--
Amortized value, year 24	47	28	--	--
Yield anticipation 4				
Maximum amortized value	103	81	99	79
Amortized value, year 20	95	72	84	63
Amortized value, year 24	103	81	96	74
Yield anticipation 5				
Maximum amortized value	186	160	123	96
Amortized value, year 20	152	128	113	83
Amortized value, year 24	173	147	121	93
Yield anticipation 6				
Maximum amortized value	216	190	150	128
Amortized value, year 20	193	167	145	121
Amortized value, year 24	209	182	149	127
Yield anticipation 7				
Maximum amortized value	264	236	244	219
Amortized value, year 20	245	215	229	203
Amortized value, year 24	260	230	242	215
Year anticipation 8				
Maximum amortized value	--	--	258	232
Amortized value, year 20	--	--	245	218
Amortized value, year 24	--	--	256	229
Yield anticipation 9				
Maximum amortized value	--	--	317	287
Amortized value, year 20	--	--	308	276
Amortized value, year 24	--	--	317	286

TABLE 19

Marginal or Annual Net Revenues for Trees Over 15 Years of Age with a Price of $60.00 per Ton, Selected Yields

Yields (tons per acre)	Marginal net revenue per acre (dollars)
11.0	6
11.5	29
12.0	53
12.5	76
13.0	99
13.5	123
14.0	146
14.5	169
15.0	192
15.5	216
16.0	239
16.5	262
17.0	286
17.5	309
18.0	332

year, e.g., year 20, has no effect upon the amortized value up to and including that specified year. Thus if yields decrease much more rapidly after year 20 than was assumed in this investigation the amortized values will not be changed for the first 20 years.

Tables 18 and 19 can be used as a rough guide in determining the optimum age to replace trees assuming that the yields for the first 20 years or so are the same as those used throughout the rest of this investigation (see Table 15 and 16). For example if the orchardist's anticipated yields for the present and following orchards were identical to yield anticipations 3 (early varieties) for at least the first 20 years he would consider replacing the present orchard when the yields fell below 11.5 tons per acre.[1/] For yield anticipations 7 (early varieties) and a discount rate of 3 per cent the orchardist would consider replacing the present orchard when its yields fell below 16.5 tons. Presenting the optimum replacement date in this manner has the advantage that it is more easily understood and it will serve as an adequate guide in most instances. Also this method is more flexible for determining the replacement date for trees more than 20 years old.

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1/ This assumes a 5 per cent discount rate for time preference, with a 3 per cent discount rate, the yield would have to decrease to about 12.0 tons.

VIII. SUMMARY AND CONCLUSIONS

A large number of cling peach producers in California are presently confronted with the basic decision of determining the age at which they should replace their older blocks of trees in order to maximize net revenue over time. This decision is based upon their anticipated yields in the future from their blocks of trees presently in production and the blocks of trees immediately following and the anticipated costs and prices received for cling peaches.

More than 800 blocks of peaches were included in a sample of cling peach producers in California conducted in the winter of 1957. The questionnaire was not designed to obtain information that would permit an adequate statistical analysis of the effects of several different levels of annual inputs upon yields. Rather it was designed to obtain information that would permit a number of representative (anticipated) yield curves to be constructed and to obtain information on representative costs and the related physical inputs. The effect of the resource base, i.e., soil, climate and spacing and variety of trees, was investigated in order to determine the amount of aggregation of the data that would be permissable. From the available information it appeared that the effect of variety upon yields was significant. Therefore, the information on yields was tabulated into two groups, the early maturing varieties and the late maturing varieties. Information on 1956 yields were tabulated and plotted for the early and the late maturing varieties. Because of the large variation in yields for trees of the same age and variety these yields were also segregated into above average and below average yields. Yield information for the previous 3 years was obtained from farmers whenever it was available. This information indicated that the average yields for the 1953-1956 period were below the 1956 yields. In order to determine if a block of peaches that had above (below) average yields in 1956 was apt to have had above (below) average yields in the previous years. The average yields for the 4 year period, 1953-1956, were tabulated according to whether they had above (below) average yields in 1956. Although these were a fairly large number of exceptions the data indicated that those blocks with above (below) average yields in 1956 tended to have above (below) average yields in the previous years. In addition to the actual yields the farmers' evaluations of poor, average and above average yields for trees the same age as their present blocks of trees were available.

The information on actual yields and the farmers evaluations of yields were used to construct 16 representative (anticipated) yield curves. Seven of the curves were for early maturing varieties and 9 for late maturing varieties.

Costs, based upon the physical inputs, and 1959 prices, were determined for each of the anticipated yield curves for a 30 year period. The fixed costs were applicable to a 40 acre cling peach orchard. The variable costs were determined as a function of age or a function of yields. Using the price of $60.00 per ton for peaches the annual net revenues were calculated for each of the yield curve over a 30 year period.

In order to determine the optimum age at which to replace trees the following criterion was developed. The optimum time to replace is when the marginal (annual) net revenue from the present enterprise is equal to the highest amortized present value of expected net revenue from the enterprise immediately following. In this investigation the enterprise in question is the cling peach enterprise. However, the criterion is also applicable to other enterprises such as feeder cattle or timber production.

When the stream of anticipated revenue from the following block of trees becomes higher than the annual net revenue from the present trees it is time to replace the present trees. Thus the optimum replacement date is determined by present yields and revenues and the yields and the value of the stream of revenue from the following trees. In order to obtain this stream of revenue it is necessary to determine the present value of the anticipated net revenue from the following block of trees. Because of time preference the anticipated net revenue is discounted to the present time and then converted into an equivalent stream of revenue. The higher the discount rate, which is a function of the value placed on present income, the longer the operator will keep his present block of trees.

When the operators anticipations with respect to yields from the following block of trees is identical to that from his present block of trees the analysis indicates that he will maximize net revenue over time, assuming that his discount rate for time preference is 5 per cent, if he replaces the present trees after 25 to 30 or more years. The exact year depends upon the anticipated yield curve under consideration. If the discount rate is 3 per cent the optimum replacement age is 1 or 2 years less. However, if the operators yield anticipations are somewhat higher for the following block than for the present block of trees the optimum replacement age may be less than 20 years for the present block.

A change in fixed costs, a $5.00 per ton increase or decrease in the price received for cling peaches and a 10 per cent increase or decrease in variable costs, had little or no effect upon the optimum replacement age. Thus the results of the analysis are applicable to different sizes of orchards and for different price levels than those assumed in the analysis. The yield curves for the trees over 20 years of age were based on a relatively few observations. Therefore, it is not known how accurately they depict the actual situation. However, the amortized values at the end of 20 years were within approximately $20.00 of their maximum value. This is the equivalent of approximately 1/2 ton of peaches. Thus if the yields per acre decrease considerably faster than the anticipated yields curves indicate after the trees are older than 20 years the optimum replacement age can still be predicted rather closely.

APPENDIX A

THE SAMPLE OF ORCHARDS; POPULATION AND SAMPLE ESTIMATES OF YIELDS BY AGE AND MATURITY DATE; AND POPULATION ESTIMATES OF YIELDS BY AGE, MATURITY DATE AND AREA OF PRODUCTION, 1953 THROUGH 1956.

Appendix A relates to Section III in the manuscript.

Sample of Orchards

The primary source of information for this study was a survey of cling peach producers in California conducted in the winter of 1957. The sampling unit was an orchard. From the approximately 200 orchardists personally interviewed, 184 usable questionnaires were obtained. However, information from more than 200 orchards was actually included in this survey. In a number of instances the orchardist being interviewed operated more than one cling peach orchard and gave the interviewer information on his operational unit rather than on a particular orchard:

There are more than 3,000 cling peach orchards in the four areas included in this investigation. It is estimated that the sample included approximately 7 per cent of the orchards in these areas. The number of schedules randomly obtained in each of the four areas is approximately proportional to the number of orchards in each area.[1/]

Although the sampling unit was an orchard or operational unit much of the analysis is based upon a sub unit of an orchard. The sub unit is a block of peach trees within an orchard of the same variety and age that are physically adjacent. Different varieties of trees or trees of the same variety and age but located in different areas of an orchard are considered as being different blocks of peach trees. More than 800 blocks of peach trees were included in the sample. Although this might appear to be a large number of observations it would require 1,500 blocks to have 1 observation for each of the 15 major varieties for a 25 year period in each of the 4 areas.

1/ The sample was a stratified random sample. The allocation was proportional to the size of the strata.

In addition to the stratified random sample 16 detailed schedules were obtained from orchardists recommended by Farm Advisors. Information was obtained from these orchardists with respect to the resource base available to them and the physical and monetary inputs and timing of all of their operations. This included information on the pulling and replanting of cling peach trees.1/

Sample and Population Estimates of Yields

Population estimates of cling peach yields are compiled by the Cling Peach Advisory Board by maturity date for all cling peaches delivered to the canneries in California. Therefore, the yield estimates from the sample of the orchards can be compared with the population estimates. The population and sample estimates of yields in 1956 by maturity date and age are presented in this Appendix, Table 1 for the Yuba City and Modesto areas. The Cling Peach Advisory Board publication reports the yields in 3 age groups for trees 7 years old and older. These are the average yields per acre for trees 7-16 years, trees 17-21 years and trees 22 years old and older.2/

The sample estimates of yields average approximately 1.5 tons per acre higher than the population estimates. There are several reasons for the upward bias of the sample estimates. One reason is the bias in the

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1/ After the physical data from all of the schedules were compiled and summarized the results were checked by a group of cling peach producers in the Yuba City area at a meeting conducted in cooperation with the farm advisor. In addition several orchardists were contacted individually to check the physical inputs. Appropriate changes were then made in the original data.

2/ Orchard and Production Survey, 1956-57; Cling Peach Advisory Board, San Francisco, California.

collection of the data. An orchardist may have deleted some of the blocks of peaches with extremely poor yields when he gave the yield data to the interviewer. Another reason for the upward bias in the sample is that some of the orchards or blocks of peaches in the Yuba City area that were damaged by the flood in the winter of 1955-56 were deleted from the sample. The third reason for the upward bias is that some of the extremely poor yields were deleted in the analysis where the low yields were a result of unusual circumstances, e.g., the flood. Taking this into consideration it appears that the sample estimates of yields are a fairly reliable indicator of all yields in the Yuba City and Modesto areas.

Yields of Cling Peaches by Maturity Date and Age
Sample and Population Estimates for the Two Major Producing Areas
California, 1956, Tons Per Acre

Maturity date	Age of trees				
	5 years	6 years	7-16 years	17-21 years	22 years and over
	tons per acre				
Population Estimates:[a]					
Extra early	7.3	11.0	15.4	13.1	--
Earlies	6.4	10.9	14.4	13.6	11.9
Lates	8.4	13.9	16.9	14.9	14.2
Extra late	6.2	14.8	16.4	13.5	10.4
All varieties	7.1	12.8	15.7	14.4	13.2
Sample Estimates:[b]					
Extra early	5.3	13.1	16.6	17.7	--
Earlies	7.8	13.8	15.5	15.4	13.7
Lates	10.8	15.2	17.5	16.5	15.3
Extra late	6.9	8.5	14.1	13.5	17.6
All varieties	8.8	13.9	16.5	16.1	14.7

a/ Orchard and Production Survey, 1956-57, Cling Peach Advisory Board. The yields were calculated by dividing the total yield by total number of acres.

b/ The yields were calculated by adding the average yields of each block of peaches together and dividing by the number of blocks. Thus these yields are not weighted by acreage.

APPENDIX A, TABLE 2

Yields of Cling Peaches by Maturity Date and Age, Yuba City and Modesto Areas, California, 1953-1956, Tons Per Acre

Maturity date and year	Age of cling peach trees and area of production									
	5 years		6 years		7-16 years		17-21 years		22 years and over	
	Yuba City area	Modesto area	Yuba City area	Modesto area	Yuba City area	Modesto area	Yuba City area	Modesto area	Yuba City area	Modesto area
	tons per acre									
Extra Early										
1953	9.67a/	6.14	10.82b/	6.50	13.34	11.47	9.09a/	6.79b/	c/	c/
1954	4.17a/	8.04	9.05a/	8.04	9.75	11.40	4.50a/	6.17	c/	c/
1955	4.24a/	4.82b/	4.43a/	11.37	10.50	12.91	6.13a/	9.25	c/	c/
1956	7.29	7.29	13.37a/	10.12b/	15.21	15.42	13.31a/	13.05b/	c/	c/
Ave. 1953-56	6.36	6.57	9.42	9.01	12.20	12.80	8.26	8.82	--	--
Earlies										
1953	6.28	3.88	10.42	5.84	15.04	12.11	14.57	12.15	12.54	10.73
1954	4.48	5.90	7.47	8.83	10.03	11.16	9.56	11.62	9.36	10.27
1955	3.09	6.16	6.78	10.79	10.38	13.42	10.97	12.04	9.55	11.35
1956	6.73	5.99	12.06	9.55	15.73	13.26	14.67	12.04	13.42	11.12
Ave. 1953-56	5.14	5.81	9.18	8.75	12.80	12.49	12.44	11.96	11.22	10.87
Lates										
1953	8.84	5.32	12.57	8.84	16.95	14.77	15.25	14.92	14.59	13.60
1954	6.62	6.60	10.00	9.95	11.78	12.97	10.49	13.32	10.82	12.79
1955	4.47	7.77	8.21	11.76	12.88	15.24	11.13	16.07	10.81	15.28
1956	8.78	7.83	15.02	12.75	18.37	15.06	16.03	13.96	15.58	13.50
Ave. 1953-56	7.18	6.88	11.45	10.82	15.00	14.51	13.22	14.57	12.95	13.79
Extra Late										
1953	4.50	6.31	8.36	6.76	10.15	13.79	4.85a/	14.51b/	8.95	11.98
1954	5.72b/	7.84b/	9.45	10.80	9.05	12.64	2.57a/	13.66	7.18a/	9.59
1955	3.38	7.48	7.86	12.32b/	12.45	15.39	14.27	15.89	6.75	10.71
1956	7.36	5.74	17.65	12.09	18.79	15.20	18.54a/	13.20	12.70a/	10.28
Ave. 1953-56	5.24	6.84	10.83	10.49	12.61	14.26	10.06	14.32	8.90	10.64
All Varieties										
1953	6.86	5.01	10.71	6.79	15.38	13.23	14.92	14.15	12.89	11.76
1954	5.45	6.78	8.85	9.49	10.67	12.05	10.12	12.81	9.86	11.10
1955	3.72	6.87	7.35	11.38	11.72	14.25	11.09	15.01	10.12	13.18
1956	7.67	6.65	14.27	11.25	17.20	14.57	15.53	13.46	14.84	12.40
Ave. 1953-56	5.92	6.33	10.30	9.73	13.74	13.52	12.92	13.86	11.93	12.11

APPENDIX A, TABLE 3

Yields of Cling Peaches by Maturity Date and Age, Linden and Visalia Areas, California, 1953-1956, Tons Per Acre

Maturity date and year	Age of cling peach trees and area of production									
	5 years		6 years		7-16 years		17-21 years		22 years and over	
	Linden area	Visalia area	Linden area	Visalia area	Linden area	Visalia area	Linden area	Visalia area	Linden area	Visalia area
	tons per acre									
Extra Early										
1953	c/	4.43b/	6.79a/	7.75b/	7.41a/	8.82b/	c/	c/	c/	c/
1954	c/	c/	c/	5.85b/	8.01a/	8.33	c/	c/	c/	c/
1955	c/	7.78a/	c/	c/	6.81a/	11.02	c/	c/	c/	c/
1956	c/	11.70a/	c/	11.33a/	15.18a/	13.73	c/	c/	c/	c/
Ave. 1953-56	c/	7.96	6.79	8.30	9.35	10.48	--	--	--	--
Earlies										
1953	3.08b/	4.60	3.79b/	11.16a/	6.72	11.07	6.74	10.57b/	7.08	10.64
1954	2.99a/	3.57a/	6.17b/	7.79	6.92	10.03	6.49	10.37	7.11	9.24
1955	1.87b/	13.25b/	4.62a/	6.78a/	5.83	12.80	5.48	13.46	6.51	12.02
1956	5.60	5.63b/	7.69b/	14.06b/	11.28	13.52	11.28	12.58	10.26	11.34
Ave. 1953-56	3.38	6.76	5.61	9.95	7.69	11.86	7.50	11.74	7.74	10.81
Lates										
1953	4.25b/	7.32a/	8.58a/	8.03a/	8.13	13.50	7.77	12.87	7.97	10.85
1954	4.94b/	11.66a/	6.84b/	9.05a/	9.07	11.54	8.72	11.61	8.35	5.91
1955	3.03b/	16.67a/	7.46b/	12.17a/	8.28	16.07	8.16	14.48	7.08	9.29
1956	7.84	8.22a/	7.24a/	15.99a/	13.57	15.44	13.14	13.99	11.69	9.70
Ave. 1953-56	5.02	9.22	7.53	13.31	9.76	14.14	9.45	13.24	8.77	8.94
Extra Late										
1953	6.09b/	3.53a/	5.88a/	8.43a/	5.28	12.88	5.13a/	14.52	8.06a/	10.53a/
1954	4.17a/	2.65a/	10.76b/	6.73a/	8.74	11.54	7.66a/	7.89	7.27a/	9.87a/
1955	6.34a/	23.98a/	4.65a/	8.09a/	9.06	15.32	6.60b/	13.13	8.14a/	11.96a/
1956	8.90b/	8.94a/	12.39a/	14.68a/	14.38	14.57	12.67b/	15.69	9.03a/	12.70a/
Ave. 1953-56	6.38	9.78	8.42	9.48	9.36	13.58	8.02	12.81	8.12	11.26
All Varieties										
1953	4.49	4.82	5.32b/	8.41	7.31	12.53	7.32	12.94	7.53	10.72
1954	4.33b/	3.32b/	7.97	7.27	8.40	10.89	7.99	10.86	7.67	8.01
1955	2.79	14.25	6.19b/	7.64b/	7.75	14.29	7.11	14.17	6.96	10.85
1956	7.23	7.95	7.98	14.23	13.19	14.45	12.55	14.07	11.04	10.54
Ave. 1953-56	4.71	7.58	6.86	9.39	9.16	13.04	8.74	13.01	8.30	10.03

a/ Based on observations from 5-49.9 acres of peaches.
b/ Based on observations from 50-100 acres of peaches.
c/ Less than 5 acres of peaches.

Source: Orchard and Production Survey, Annual Issues 1953-54 to 1956-57, Cling Peach Advisory Board.

APPENDIX B

SUMMARY OF COSTS THAT DO NOT VARY WITH OUTPUT AND PRE-HARVEST VARIABLE COSTS BY AGE OF TREE

Appendix B contains a summary of the costs presented in Sectinn V of the manuscript.

APPENDIX B, TABLE 1

Summary of Costs that Do Not Vary with Output

Age of Tree	Depreciation	Interest	Taxes	Miscellaneous	Total
1	$43.72	$77.82	$17.50	$9.00	$148.04
2	43.72	77.82	18.00	9.00	148.54
3	43.72	77.82	18.50	9.00	149.04
4	49.09	80.07	19.50	9.00	157.66
5	49.09	80.07	20.00	9.00	158.16
6	49.09	80.07	20.50	9.00	158.66
7	49.09	80.07	21.00	9.00	159.16
8	49.09	80.07	21.50	9.00	159.66
9	49.09	80.07	22.00	9.00	160.16
10	49.09	80.07	22.50	9.00	160.66
11	49.09	80.07	22.50	9.00	160.66
12	49.09	80.07	22.50	9.00	160.66
13	49.09	80.07	22.50	9.00	160.66
14	49.09	80.07	22.50	9.00	160.66
15	49.09	80.07	22.50	9.00	160.66
16	49.09	80.07	21.00	9.00	159.16
17	49.09	80.07	21.00	9.00	159.16
.	.	.	.	.	.
.	.	.	.	.	.
.	.	.	.	.	.
30	49.09	80.07	21.00	9.00	159.16

APPENDIX B, TABLE 2

Pre-harvest Variable Costs for 1 Year Old Trees

Operation	Labor, tractor, and equipment required	Cost per acre				
		labor[a]	tractor	equip.	supplies	total cost
Pre-harvest cost						
Pruning	none					
Brush disposal	none					
Thinning	none					
Fertilization	one man, wheel tractor and spreader	.63	.42		3.00	4.05
Wiring	none					
Propping	none					
Irrigation	one man for 6 hours	7.50			5.00	12.50
Seed cover crop	one man, wheel tractor, disc, harrow, drill	1.75	1.19	.60	2.40	5.94
Cultivation	one man, tracklayer, disc, ridger	5.00	5.00	1.21		11.21
Spraying	one man, tracklayer, spray rig	.38	.31	.48	1.80	2.97
Miscellaneous	b/	2.17	1.25	8.20		11.62
Total pre-harvest cost		17.43	8.17	10.49	12.20	48.29

APPENDIX B, TABLE 3

Pre-harvest Variable Costs for 2 Year Old Trees

Operation	Labor, tractor, and equipment required	Cost per acre				
		labor[a]	tractor	equip.	supplies	total cost
Pre-harvest cost						
Pruning	12.0 hours @ $1.10 per hour	13.20				13.20
Brush disposal	one man, wheel tractor and disc	.63	.42	.25		1.30
Thinning	none					
Fertilization	one man, wheel tractor and spreader	.63	.42		6.00	7.05
Wiring	none					
Propping	none					
Irrigation	one man for 6 hours	7.50			5.00	12.50
Seed cover crop	one man, wheel tractor, disc, harrow, drill	1.75	1.19	.60	2.40	5.94
Cultivation	one man, tracklayer, disc, ridger	5.00	5.00	1.21		11.21
Spraying	one man, tracklayer, spray rig	.75	.63	.95	3.30	5.63
Miscellaneous	b/	3.50	1.25	8.20		12.95
Total pre-harvest cost		32.96	8.91	11.21	16.70	69.78

APPENDIX B, TABLE 4

Pre-harvest Variable Costs for 3 Year Old Trees

Operation	Labor, tractor, and equipment required	Cost per acre				
		labor[a]	tractor	equip.	supplies	total cost
Pre-harvest cost						
Pruning	15 hours @ $1.10 per hour	16.50				16.50
Brush disposal	one man, wheel tractor and disc	.63	.42	.25		1.30
Thinning	none					
Fertilization	one man, wheel tractor and spreader	.63	.42		9.75	10.80
Wiring	none					
Propping	none					
Irrigation	one man for 6 hours	7.50			5.00	12.50
Seed cover crop	one man, wheel tractor, disc, harrow, drill	1.75	1.19	.60	2.40	5.94
Cultivation	one man, tracklayer, disc, ridger	5.00	5.00	1.21		11.21
Spraying	one man, tracklayer, spray rig	1.13	.94	1.43	4.80	8.30
Miscellaneous	b/	3.99	1.25	8.20		13.44
Total pre-harvest cost		37.13	9.22	11.69	21.95	79.99

a/ Labor costs at $1.25 per hour unless otherwise specified.

b/ Miscellaneous includes such work as leveling with scraper, cost of operating the pickup truck ($8.00/acre), compensation insurance, social security payments and interest on operating costs.

APPENDIX B, TABLE 5

Pre-harvest Variable Costs for 4 Year Old Trees

Operation	Labor, tractor, and equipment required	Cost per acre				
		labor[a]	tractor	equip.	supplies	total cost
Pre-harvest cost						
Pruning	21 hours @ $1.10 per hour	23.10				23.10
Brush disposal	one man, wheel tractor, and disc	.63	.42	.25		1.30
Thinning	contract	20.00				20.00
Fertilization	one man, wheel tractor and spreader	.63	.42		13.20	14.25
Wiring	one man for 5 hours	6.25			22.75	29.00
Propping	none					
Irrigation	one man for 8 hours	10.00			5.00	15.00
Seed cover crop	one man, wheel tractor, disc, harrow, drill	1.75	1.19	.60	2.40	5.94
Cultivation	one man, tracklayer, disc, ridger	7.50	7.50	1.92		16.92
Spraying	one man, tracklayer, spray rig	1.63	1.37	2.09	10.00	15.09
Miscellaneous	b/	8.18	1.25	8.20		17.63
Total pre-harvest cost		79.67	12.15	13.06	53.35	158.23

APPENDIX B, TABLE 6

Pre-harvest Variable Costs for 5 Year Old Trees

Operation	Labor, tractor, and equipment required	Cost per acre				
		labor[a]	tractor	equip.	supplies	total cost
Pre-harvest cost						
Pruning	30 hours @ $1.10 per hour	33.00				33.00
Brush disposal	one man, wheel tractor and disc	.63	.42	.25		1.30
Thinning	contract	50.00				50.00
Fertilization	one man, wheel tractor and spreader	.63	.42		16.50	17.55
Wiring	one man for one hour	1.25				1.25
Propping	one man, wheel tractor, trailer	1.25	.17			1.42
Irrigation	one man for 8 hours	10.00			5.00	15.00
Seed cover crop	one man, wheel tractor, disc, harrow, drill	1.75	1.19	.60	2.40	5.94
Cultivation	one man, tracklayer, disc, ridger	7.50	7.50	1.92		16.92
Spraying	one man, tracklayer, spray rig	1.87	1.56	2.37	20.00	25.80
Miscellaneous	b/	10.37	1.25	8.20		19.82
Total pre-harvest cost		118.25	12.51	13.34	43.90	188.00

APPENDIX B, TABLE 7

Pre-harvest Variable Costs for 6 Year Old Trees

Operation	Labor, tractor, and equipment required	Cost per acre				
		labor[a]	tractor	equip.	supplies	total cost
Pre-harvest cost						
Pruning	44 hours @ $1.10 per hour	48.40				48.40
Brush disposal	one man, wheel tractor and disc	.63	.42	.25		1.30
Thinning	contract	70.00				70.00
Fertilization	one man, wheel tractor and spreader	.63	.42		19.80	20.85
Wiring	one man for 10 hours	12.50			15.00	27.50
Propping	one man, wheel tractor and trailer	2.50	.26			2.76
Irrigation	one man for 8 hours	10.00			5.00	15.00
Seed cover crop	one man, wheel tractor, disc, harrow, drill	1.75	1.19	.60	2.40	5.94
Cultivation	one man, tracklayer, disc, ridger	7.50	7.50	1.92		16.92
Spraying	one man, tracklayer, spray rig	2.13	1.75	2.66	30.00	36.54
Miscellaneous	b/	14.78	1.25	8.20		24.23
Total pre-harvest cost		170.82	12.79	13.63	72.20	269.44

a/ Labor costs at $1.25 per hour unless otherwise specified.

b/ Miscellaneous includes such work as leveling with scraper, cost of operating the pickup truck ($8.00/acre), compensation insurance, social security payments and interest on operating costs.

APPENDIX B, TABLE 8

Pre-harvest Variable Costs for 7 Year Old Trees

Operation	Labor, tractor, and equipment required	Cost per acre				
		labor[a/]	tractor	equip.	supplies	total cost
Pre-harvest cost						
Pruning	48 hours @ $1.10 per hour	52.80				52.80
Brush disposal	one man, wheel tractor, trailer, disc	2.50	1.70	.40		4.60
Thinning	contract	90.00				90.00
Fertilization	one man, wheel tractor and spreader	.63	.42		19.80	20.85
Wiring	one man for one hour	1.25				1.25
Propping	one man, wheel tractor and trailer	3.75	.36			4.11
Irrigation	one man for 8 hours	10.00			5.00	15.00
Seed cover crop	one man, wheel tractor, disc, harrow, drill	1.75	1.19	.60	2.40	5.94
Cultivation	one man, tracklayer, disc, ridger	7.50	7.50	1.92		16.92
Spraying	one man, tracklayer, spray rig	2.50	1.88	2.85	40.00	47.23
Miscellaneous	b/	16.16	1.25	8.20		25.61
Total pre-harvest cost		188.84	14.30	13.97	67.20	284.31

APPENDIX B, TABLE 9

Pre-harvest Variable Costs for 8 Year Old Trees

Operation	Labor, tractor, and equipment required	Cost per acre				
		labor[a/]	tractor	equip.	supplies	total cost
Pre-harvest cost						
Pruning	52 hours @ $1.10 per hour	57.20				57.20
Brush disposal	one man, wheel tractor, trailer, disc	2.50	1.70	.40		4.60
Thinning	contract	105.00				105.00
Fertilization	one man, wheel tractor and spreader	.63	.42		22.50	23.55
Wiring	one man for one hour	1.25				1.25
Propping	one man, wheel tractor, trailer	5.00	.42	.05		5.47
Irrigation	one man for 8 hours	10.00			5.00	15.00
Seed cover crop	one man, wheel tractor, disc, harrow, drill	1.75	1.19	.60	2.40	5.94
Cultivation	one man, tracklayer, disc, ridger	7.50	7.50	1.92		16.92
Spraying	one man, tracklayer, spray rig	2.50	1.88	2.85	40.00	47.23
Miscellaneous	b/	17.93	1.25	8.20		27.38
Total pre-harvest cost		211.26	14.36	14.02	69.90	309.54

APPENDIX B, TABLE 10

Pre-harvest Variable Costs for 9 Year Old Trees

Operation	Labor, tractor, and equipment required	Cost per acre				
		labor[a/]	tractor	equip.	supplies	total cost
Pre-harvest cost						
Pruning	52 hours @ $1.10 per hour	57.20				57.20
Brush disposal	one man, wheel tractor, trailer, disc	2.50	1.70	.40		4.60
Thinning	contract	115.00				115.00
Fertilization	one man, wheel tractor, spreader	.63	.42		22.50	23.55
Wiring	one man for 10 hours	12.50			18.00	30.50
Propping	one man, wheel tractor, trailer	6.25	.42	.05		6.72
Irrigation	one man for 8 hours	10.00			5.00	15.00
Seed cover crop	one man, wheel tractor, disc, harrow, drill	1.75	1.19	.60	2.40	5.94
Cultivation	one man, tracklayer, disc, ridger	7.50	7.50	1.92		16.92
Spraying	one man, tracklayer, spray rig	2.50	1.88	2.85	40.00	47.23
Miscellaneous	b/	20.30	1.25	8.20		29.75
Total pre-harvest cost		236.13	14.36	14.02	87.90	352.41

a/ Labor costs at $1.25 per hour unless otherwise specified.

b/ Miscellaneous includes such work as leveling with scraper, cost of operating the pickup truck ($8.00/acre), compensation insurance, social security payments and interest on operating costs.

APPENDIX B, TABLE 11

Pre-harvest Variable Costs for 10 Year Old Trees

Operation	Labor, tractor, and equipment required	Cost per acre				
		labor[a]	tractor	equip.	supplies	total cost
Pre-harvest cost						
Pruning	52 hours @ $1.10 per hour	57.20				57.20
Brush disposal	one man, wheel tractor, trailer, disc	2.50	1.70	.40		4.60
Thinning	contract	125.00				125.00
Fertilization	one man, wheel tractor, spreader	.63	.42		22.50	23.55
Wiring	one man for one hour.	1.25				1.25
Propping	one man, wheel tractor, trailer	6.25	.42	.05		6.72
Irrigation	one man for 8 hours	10.00			5.00	15.00
Seed cover crop	one man, wheel tractor, disc, harrow, drill	1.75	1.19	.60	2.40	5.94
Cultivation	one man, tracklayer, disc, ridger	7.50	7.50	1.92		16.92
Spraying	one man, tracklayer, spray rig	2.50	1.88	2.85	40.00	47.23
Miscellaneous	b/	19.41	1.25	8.20		28.86
Total pre-harvest cost		233.99	14.36	14.02	69.90	332.27

APPENDIX B, TABLE 12

Pre-harvest Variable Costs for 11 Year Old Trees

Operation	Labor, tractor, and equipment required	Cost per acre				
		labor[a]	tractor	equip.	supplies	total cost
Pre-harvest cost						
Pruning	52 hours @ $1.10 per hour	57.20				57.20
Brush disposal	one man, wheel tractor, trailer, disc	2.50	1.70	.40		4.60
Thinning	contract	130.00				130.00
Fertilization	one man, wheel tractor, spreader	.63	.42		22.50	23.55
Wiring	one man for one hour	1.25				1.25
Propping	one man, wheel tractor, trailer	6.25	.42	.05		6.72
Irrigation	one man for 8 hours	10.00			5.00	15.00
Seed cover crop	one man, wheel tractor, disc, harrow, drill	1.75	1.19	.60	2.40	5.94
Cultivation	one man, tracklayer, disc, ridger	7.50	7.50	1.92		16.92
Spraying	one man, tracklayer, spray rig	2.50	1.88	2.85	40.00	47.23
Miscellaneous	b/	20.85	1.25	8.20		30.30
Total pre-harvest cost		240.43	14.36	14.02	69.90	338.71

APPENDIX B, TABLE 13

Pre-harvest Variable Costs for 12 Year Old and Over Trees

Operation	Labor, tractor, and equipment required	Cost per acre				
		labor[a]	tractor	equip.	supplies	total cost
Pre-harvest cost						
Pruning	52 hours @ $1.10 per hour	57.20				57.20
Brush disposal	one man, wheel tractor, trailer, disc	2.50	1.70	.40		4.60
Thinning	contract	135.00				135.00
Fertilization	one man, wheel tractor, spreader	.63	.42		22.50	23.55
Wiring	one man for one hour	1.25				1.25
Propping	one man, wheel tractor, trailer	6.25	.42	.05		6.72
Irrigation	one man for 8 hours	10.00			5.00	15.00
Seed cover crop	one man, wheel tractor, disc, harrow, drill	1.75	1.19	.60	2.40	5.94
Cultivation	one man, tracklayer, disc, ridger	7.50	7.50	1.92		16.92
Spraying	one man, tracklayer, spray rig	2.50	1.88	2.85	40.00	47.23
Miscellaneous	b/	21.25	1.25	8.20		30.70
Total pre-harvest cost		245.83	14.36	14.02	69.90	344.11

a/ Labor costs at $1.25 per hour unless otherwise specified.

b/ Miscellaneous includes such work as leveling with scraper, cost of operating the pickup truck ($8.00/acre), compensation insurance, social security payments and interest on operating costs.

APPENDIX C

ANTICIPATED YIELDS, NET REVENUES AND MAXIMUM AMORTIZED VALUES

Appendix C contains data used in the analysis in Section VII of the manuscript.

APPENDIX C, TABLE 1

Expectations with Respect to Yields and Adjusted Annual Net Revenues for Early and Extra Early Varieties[a/]

Age of trees (years)	Anticipations No. 1		Anticipations No. 2		Anticipations No. 3		Anticipations No. 4	
	Yield (tons)	Annual net revenue	Yield (tons)	Annual net revenue	Yield (tons)	Annual net revenue	Yield (tons)	Annual net revenue
0	0	$ -283.00	0	$ -283.00	0	$ -283.00	0	$ -283.00
1	0	-215.81	0	-215.87	0	-215.81	0	-215.81
2	0	-249.50	0	-249.50	0	-249.50	0	-249.50
3	0	-273.93	0	-273.93	1.0	-227.33	1.0	-227.33
4	3.0	-241.28	3.0	-241.28	4.0	-191.83	4.0	-191.83
5	5.0	-192.73	5.0	-192.73	8.0	- 47.01	8.0	- 47.01
6	8.5	-122.96	8.5	-122.96	12.8	92.15	12.8	92.15
7	10.5	- 52.41	10.9	- 33.75	14.5	161.61	14.7	170.95
8	11.5	- 34.62	12.7	22.48	15.0	168.90	15.8	206.78
9	11.8	- 66.08	14.0	41.09	15.0	135.67	17.0	231.80
10	12.0	- 41.07	14.8	100.52	15.0	163.45	17.5	288.68
11	12.1	- 45.32	14.9	104.78	15.0	166.81	17.8	313.55[b/]
12	12.1	- 53.44	14.9	105.66	15.0	171.42	17.9	326.27
13	12.1	- 56.64	14.8	107.34	14.9	177.04[b/]	17.8	321.60
14	12.1	- 60.04	14.6	104.45	14.9	186.31	17.5	307.61
15	12.1	- 63.64	14.3	96.72	14.8	181.65	17.2	293.61
16	12.1	- 65.96	13.9	85.37	14.8	183.15	16.8	276.45
17	12.1	- 69.92	13.7	81.15	14.7	178.49	16.5	262.45
18	12.0	- 78.78	13.4	72.03	14.5	169.15	16.2	248.46
19	11.8	- 92.83	13.0	57.69	14.4	164.49	15.8	229.80
20	11.6	-107.73	12.5	37.82	14.2	155.16	15.4	211.14
21	11.3	-128.20	12.0	16.76	14.0	145.83	15.0	192.48
22	11.0	-149.88	11.5	- 5.54	13.8	136.50	14.5	169.15
23	10.7	-172.86	11.0	- 29.21	13.6	127.17	14.0	145.83
24	10.4	-197.23	10.6	- 49.62	13.4	117.84	13.6	127.17
25	10.0	-227.73	10.2	- 71.25	13.0	99.18	13.1	103.85
26	9.5	-264.71	9.6	-103.52	12.8	89.85	12.8	89.85
27	9.1	-299.25	9.1	-133.05	12.5	75.85	12.5	75.85
28	8.8	-331.21	8.8	-155.03	12.1	57.19	12.1	57.19
29	8.4	-369.34	8.4	-183.00	11.7	38.53	11.7	38.53
30	8.0	-410.58	8.0	-212.64	11.3	19.87	11.3	19.87

Age of trees (years)	Anticipations No. 5		Anticipations No. 6		Anticipations No. 7	
	Yield (tons)	Annual net revenue	Yield (tons)	Annual net revenue	Yield (tons)	Annual net revenue
0	0	$ -283.00	0	$ -283.00	0	$ -283.00
1	0	-215.81	0	-215.81	0	-215.81
2	0	-249.50	0	-249.50	0	-249.50
3	2.0	-184.63	2.0	-184.63	2.0	-184.63
4	6.0	- 95.97	6.0	- 95.97	6.0	- 95.97
5	9.5	31.28	9.5	31.28	9.5	31.28
6	15.1	212.46	16.0	254.44	16.0	254.44
7	16.4	270.48	18.0	347.63	18.4	366.29
8	17.1	293.62	18.8	380.08	19.3	404.52
9	17.7	295.86	19.3	382.84	21.0	463.08[b/]
10	18.0	342.77[b/]	19.5	412.75[b/]	21.7	515.37
11	18.0	336.33	19.6	410.97	22.0	522.93
12	18.0	330.93	19.6	405.57	22.0	517.53
13	18.0	330.93	19.5	400.91	21.8	508.20
14	18.0	330.93	19.4	396.24	21.5	494.21
15	18.0	330.93	19.3	391.47	21.4	489.54
16	18.0	332.43	19.2	388.41	21.1	474.05
17	18.0	332.43	19.0	379.08	20.7	458.39
18	18.0	332.43	18.9	374.41	20.4	444.39
19	18.0	332.43	18.6	360.42	20.0	425.73
20	18.0	332.43	18.4	351.09	19.6	407.07
21	18.0	332.43	18.2	341.76	19.4	397.74
22	17.9	327.77	17.9	327.77	19.0	379.08
23	17.7	318.43	17.7	318.43	18.6	360.42
24	17.5	309.11	17.5	309.11	18.3	346.43
25	17.2	295.11	17.2	295.11	17.9	327.77
26	17.0	285.78	17.0	285.78	17.5	309.11
27	16.8	276.45	16.8	276.45	17.2	295.11
28	16.5	262.45	16.5	262.45	16.8	276.45
29	16.1	244.00	16.1	244.00	16.4	258.00
30	15.7	225.00	15.7	225.00	15.9	234.00

a/ The annual net revenues have been adjusted for interest on the unpaid balance of the establishing costs.

b/ In this year the accumulated net revenue becomes positive (the unpaid balance of the establishing cost becomes zero). Therefore, the unadjusted and the adjusted annual net revenues are identical for this year and all following years.

APPENDIX C, TABLE 2

Anticipations with Respect to Yields and Adjusted Annual Net Revenues for Late and Extra Late Varieties[a/]

Age of trees (years)	Anticipations No. 1		Anticipations No. 2		Anticipations No. 3		Anticipations No. 4		Anticipations No. 5	
	Yield (tons)	Annual net revenue	Yield (tons)	Annual net revenue	Yield (tons)	Annual net revenue	Yield (tons)	Annual net revenue	Yield (tons)	Annual net revenue
0	0	$ -283.00	0	$ -283.00	0	$ -283.00	0	$ -283.00	0	$ -283.00
1	0	-215.81	0	-215.81	0	-215.81	0	-215.81	0	-215.81
2	0	-249.50	0	-249.50	0	-249.50	0	-249.50	0	-249.50
3	0	-273.93	0	-273.93	0	-273.93	1.0	-227.30	1.0	-227.30
4	4.5	-171.31	4.5	-171.31	4.5	-171.31	5.5	-121.85	5.5	-121.85
5	6.0	-141.87	6.0	-141.87	6.0	-141.87	8.5	- 19.49	8.5	- 19.49
6	9.0	- 92.38	9.0	- 92.38	9.0	- 92.38	14.0	153.98	14.0	153.98
7	11.0	- 19.99	11.0	- 19.99	11.0	- 19.99	15.5	217.83	16.2	250.48
8	11.9	- 4.93	13.0	46.38	13.0	46.38	16.0	228.49	17.1	281.76
9	12.0	- 43.94	13.8	43.13	14.3	66.46	16.0	198.82	17.4	269.29
10	12.0	- 27.37	14.0	74.69	14.9	118.07	16.0	230.39	17.5	309.76 b/
11	12.0	- 35.02	14.0	72.73	15.0	123.38	16.0	237.78	17.5	313.01
12	12.0	- 42.53	14.0	71.69	15.0	125.38	16.0	237.63 b/	17.5	307.61
13	12.0	- 45.07	14.0	75.99	14.9	128.24	16.0	237.63	17.4	302.94
14	12.0	- 47.77	14.0	80.55	14.5	117.27	16.0	237.63	17.2	293.61
15	12.0	- 50.64	14.0	85.39	14.1	105.65	16.0	237.63	17.0	284.28
16	12.0	- 52.18	13.9	87.35	13.9	104.17	16.0	239.13	16.7	271.79
17	12.0	- 55.31	13.6	78.59	13.6	96.42	16.0	239.13	16.4	257.79
18	12.0	- 58.63	13.4	73.98	13.4	92.87	15.9	235.80	16.2	248.46
19	12.0	- 62.14	13.2	69.08	13.2	89.11	15.8	229.80	15.8	229.80
20	12.0	- 65.87	12.8	54.57	12.8	75.80	15.6	220.47	15.6	220.47
21	12.0	- 69.83	12.5	43.84	12.5	66.35	15.3	206.47	15.3	206.47
22	12.0	- 74.01	12.2	32.48	12.2	56.34	14.8	183.15	14.8	183.15
23	11.9	- 83.12	11.9	20.44	11.9	45.73	14.5	169.15	14.5	169.15
24	11.5	-106.76	11.5	3.01	11.5	29.21 b/	14.4	164.49	14.4	164.49
25	11.0	-136.50	11.0	- 20.14	11.0	5.88	14.1	150.49	14.1	150.49
26	10.6	-163.35	10.6	- 40.01	10.6	- 12.78	13.9	141.17	13.9	141.17
27	10.2	-191.81	10.2	- 61.07	10.2	- 31.44	13.6	127.17	13.6	127.17
28	10.0	-212.65	10.0	- 74.06	10.0	- 40.77	13.4	117.84	13.4	117.84
29	9.5	-248.73	9.5	-101.86	9.5	- 64.09	13.1	103.85	13.1	103.85
30	9.0	-286.98	9.0	-131.27	9.0	- 87.42	13.0	99.18	13.0	99.18

Age of trees (years)	Anticipations No. 6		Anticipations No. 7		Anticipations No. 8		Anticipations No. 9	
	Yield (tons)	Annual net revenue	Yield (tons)	Annual net revenue	Yield (tons)	Annual net revenue	Yield (tons)	Annual net revenue
0	0	$ -283.00	0	$ -283.00	0	$ -283.00	0	$ -283.00
1	0	-215.81	0	-215.81	0	-215.81	0	-215.81
2	0	-249.50	0	-249.50	0	-249.50	0	-249.50
3	1.0	-227.33	2.0	-184.63	2.0	-184.63	2.0	-184.63
4	5.5	-121.85	6.5	- 72.65	6.5	- 72.65	6.5	- 72.65
5	8.5	- 19.49	12.0	149.30	12.0	149.30	12.0	149.30
6	14.0	153.98	17.3	323.56	17.3	323.56	17.3	323.56
7	16.2	250.48	19.0	406.92	19.0	406.92	20.0	453.57
8	17.8	314.42	19.6	433.59	20.0	452.25	21.4	520.36
9	18.7	331.90	20.0	416.43 b/	20.5	439.75 b/	22.4	528.39 b/
10	19.2	394.78	20.0	436.07	21.0	482.72	23.1	580.69
11	19.4	401.64 b/	20.0	429.63	21.0	476.28	23.7	602.23
12	19.3	391.57	20.0	424.23	21.0	470.88	24.0	610.83
13	19.0	377.58	20.0	424.23	21.0	470.88	24.0	610.83
14	18.6	358.92	20.0	242.23	21.0	470.88	23.9	606.17
15	18.2	340.26	20.0	424.23	20.9	466.21	23.5	587.51
16	17.7	318.43	20.0	425.73	20.5	449.05	22.6	547.02
17	17.3	299.77	20.0	425.73	20.1	430.39	22.0	519.03
18	16.8	276.45	19.8	416.41	19.8	416.41	21.5	495.71
19	16.2	248.46	19.4	397.74	19.4	397.74	21.0	472.38
20	15.6	220.47	19.0	379.08	19.0	379.08	20.5	449.05
21	15.3	206.47	18.6	360.42	18.6	360.42	19.9	421.07
22	14.8	183.15	18.1	337.09	18.1	337.09	19.4	397.74
23	14.5	169.15	17.8	323.10	17.8	323.10	18.7	365.09
24	14.4	164.49	17.5	309.11	17.5	309.11	18.2	341.76
25	14.1	150.49	17.1	290.45	17.1	290.45	17.6	313.77
26	13.9	141.17	16.8	276.45	16.8	276.45	17.2	295.11
27	13.6	127.17	16.5	262.45	16.5	262.45	16.7	271.79
28	13.4	117.84	16.0	239.13	16.0	239.13	16.2	248.46
29	13.1	103.85	15.7	225.13	15.7	225.13	15.8	229.80
30	13.0	99.18	15.5	215.81	15.5	215.81	15.5	215.81

a/ The annual net revenues have been adjusted for interest on the unpaid balance of the establishing costs.

b/ In this year the accumulated net revenue becomes positive (the unpaid balance of the establishing cost becomes zero). Therefore, the unadjusted and the adjusted annual net revenues are identical for this year and all following years.

APPENDIX C, TABLE 3

The Effects of Changes in Prices and Cost on Net Revenue and Maximum Amortized Values, Yield Anticipations Number 3, Early and Extra Early Varieties

Age of trees (years)	Yield per acre (tons)	Net revenue $60/ton	Net revenue $55/ton	Maximum amortized value		Net revenue $65/ton	Maximum amortized value		a/ Net revenue $60/ton	Maximum amortized value	
				3%	5%		3%	5%		3%	5%
0	0	-283.00	-283.00			-283.00			-283.00		
1	0	-216.00	-216.00			-216.00			-166.00		
2	0	-250.00	-250.00			-250.00			-197.00		
3	1.0	-227.00	-232.00			-222.00			-171.00		
4	4.0	-192.00	-212.00			-172.00			-132.00		
5	8.0	- 47.00	- 88.00			- 5.00			16.00		
6	12.8	92.00	24.00			160.00			159.00		
7	14.5	162.00	81.00			242.00			233.00		
8	15.0	169.00	81.00			257.00			244.00		
9	15.0	136.00	42.00			229.00			215.00		
10	15.0	163.00	65.00			262.00			248.00		
11	15.0	167.00	62.00			271.00			246.00		
12	115.0	171.00	60.00			266.00			241.00		
13	14.9	177.00	60.00			261.00			236.00		
14	14.9	186.00	63.00			261.00			236.00		
15	14.8	182.00	63.00			256.00			232.00		
16	14.8	183.00	68.00			257.00			233.00		
17	14.7	178.00	68.00			252.00			228.00		
18	14.5	169.00	64.00			242.00			219.00		
19	14.4	164.00	64.00			236.00			214.00		
20	14.2	155.00	59.00			226.00			205.00		
21	14.0	146.00	55.00			216.00			196.00		
22	13.8	136.00	49.00			206.00			187.00		
23	13.6	127.00	44.00			195.00			177.00		
24	13.4	118.00	38.00			185.00			168.00		
25	13.0	99.00	24.00			164.00			149.00		
26	12.8	90.00	17.00			154.00			140.00		
27	12.5	76.00	6.00			138.00			126.00	109.00	
28	12.1	57.00	- 11.00			118.00	112.00		107.00		91.00
29	11.7	39.00	- 28.00	-27.00	-38.00	97.00		91.00	89.00		
30	11.3	20.00	- 46.00			76.00			70.00		

APPENDIX C, TABLE 4

The Effects of Changes in Prices and Cost on Net Revenue and Maximum Amortized Values, Yield Anticipations Number 5, Early and Extra Early Varieties

Age of trees (years)	Yield per acre (tons)	Net revenue $60/ton	Net revenue $55/ton	Maximum amortized value		Net revenue $65/ton	Maximum amortized value		a/ Net revenue $60/ton	Maximum amortized value	
				3%	5%		3%	5%		3%	5%
0	0	-283.00	-283.00			-283.00			-283.00		
1	0	-216.00	-216.00			-216.00			-166.00		
2	0	-250.00	-250.00			-250.00			-196.00		
3	2.0	-184.00	-195.00			-175.00			-128.00		
4	6.0	- 96.00	-127.00			- 65.00			- 36.00		
5	9.5	31.00	- 19.00			81.00			94.00		
6	15.1	212.00	132.00			293.00			279.00		
7	16.4	270.00	178.00			363.00			341.00		
8	17.1	294.00	192.00			395.00			368.00		
9	17.7	296.00	185.00			398.00			359.00		
10	18.0	343.00	229.00			433.00			393.00		
11	18.0	336.00	236.00			426.00			386.00		
12	18.0	331.00	241.00			421.00			381.00		
13	18.0	331.00	241.00			421.00			381.00		
14	18.0	331.00	241.00			421.00			381.00		
15	18.0	331.00	241.00			421.00			381.00		
16	18.0	332.00	242.00			422.00			382.00		
17	18.0	332.00	242.00			422.00			382.00		
18	18.0	332.00	242.00			422.00			382.00		
19	18.0	332.00	242.00			422.00			382.00		
20	18.0	332.00	242.00			422.00			382.00		
21	18.0	332.00	242.00			422.00			382.00		
22	17.9	328.00	238.00			417.00			378.00		
23	17.7	318.00	230.00			407.00			368.00		
24	17.5	309.00	222.00			397.00			359.00		
25	17.2	295.00	209.00			381.00			345.00		
26	17.0	286.00	201.00			371.00			336.00		
27	16.8	276.00	192.00			358.00			326.00		
28	16.5	262.00	180.00			345.00			312.00		
29	16.1	244.00	176.00			334.00			294.00		
30	15.7	225.00	163.00			324.00			275.00		
31	15.3	206.00	130.00			283.00			256.00		
32	14.9	188.00	113.00	112.00		262.00	259.00		238.00	240.00	
33	14.5	169.00	97.00		90.00	242.00		234.00	219.00		216.00

a/ Fixed costs have been reduced $50.00.

APPENDIX C, TABLE 5

The Effects of Changes in Prices and Cost on Net Revenue and Maximum Amortized Values, Yield Anticipations Number 7, Early and Extra Early Varieties

Age of trees (years)	Yield per acre (tons)	Net revenue $60/ton	Net revenue $55/ton	Maximum amortized value 3%	Maximum amortized value 5%	Net revenue $65/ton	Maximum amortized value 3%	Maximum amortized value 5%	a/ Net revenue $60/ton	Maximum amortized value 3%	Maximum amortized value 5%
0	0	-283.00	-283.00			-283.00			-283.00		
1	0	-216.00	-216.00			-216.00			-166.00		
2	0	-250.00	-250.00			-250.00			-196.00		
3	2.0	-185.00	-195.00			-175.00			-128.00		
4	6.0	- 96.00	-127.00			- 65.00			- 36.00		
5	9.5	31.00	- 19.00			81.00			94.00		
6	16.0	254.00	169.00			340.00			321.00		
7	18.4	366.00	264.00			469.00			437.00		
8	19.3	405.00	291.00			518.00			477.00		
9	21.0	463.00	336.00			568.00			513.00		
10	21.7	515.00	405.00			624.00			565.00		
11	22.0	523.00	413.00			633.00			573.00		
12	22.0	518.00	408.00			628.00			568.00		
13	21.8	508.00	399.00			617.00			558.00		
14	21.5	494.00	387.00			602.00			544.00		
15	21.4	490.00	383.00			597.00			540.00		
16	21.1	474.00	369.00			580.00			524.00		
17	20.7	458.00	355.00			562.00			508.00		
18	20.4	444.00	342.00			546.00			494.00		
19	20.0	426.00	326.00			526.00			476.00		
20	19.6	407.00	309.00			506.00			457.00		
21	19.4	398.00	301.00			495.00			447.00		
22	19.0	379.00	284.00			474.00			429.00		
23	18.6	360.00	267.00			453.00			410.00		
24	18.3	346.00	255.00			438.00			396.00		
25	17.9	328.00	238.00			417.00			378.00		
26	17.5	309.00	222.00			397.00			360.00		
27	17.2	295.00	209.00			381.00			345.00		
28	16.8	276.00	192.00	183.00		360.00			326.00		
29	16.4	258.00	180.00			345.00	345.00	329.00	308.00	319.00	291.00
30	15.9	234.00	163.00		158.00	324.00			284.00		

APPENDIX C, TABLE 6

The Effects of Changes in Prices and Cost on Net Revenue and Maximum Amortized Values, Yield Anticipations Number 4, Late and Extra Late Varieties

Age of trees (years)	Yield per acre (tons)	Net revenue $60/ton	Net revenue $55/ton	Maximum amortized value 3%	Maximum amortized value 5%	Net revenue $65/ton	Maximum amortized value 3%	Maximum amortized value 5%	a/ Net revenue $60/ton	Maximum amortized value 3%	Maximum amortized value 5%
0	0	-283.00	-283.00			-283.00			-283.00		
1	0	-216.00	-216.00			-216.00			-166.00		
2	0	-250.00	-250.00			-250.00			-197.00		
3	1.0	-227.00	-232.00			-222.00			-171.00		
4	5.5	-122.00	-150.00			- 94.00			- 62.00		
5	8.5	- 19.00	- 64.00			25.00			44.00		
6	14.0	154.00	79.00			229.00			221.00		
7	15.5	218.00	131.00			304.00			289.00		
8	16.0	228.00	134.00			323.00			304.00		
9	16.0	199.00	99.00			300.00			279.00		
10	16.0	230.00	124.00			329.00			299.00		
11	16.0	238.00	125.00			323.00			293.00		
12	16.0	238.00	128.00			318.00			288.00		
13	16.0	238.00	135.00			318.00			288.00		
14	16.0	238.00	143.00			318.00			288.00		
15	16.0	238.00	152.00			318.00			288.00		
16	16.0	239.00	159.00			319.00			289.00		
17	16.0	239.00	159.00			319.00			289.00		
18	15.9	236.00	156.00			315.00			286.00		
19	15.8	230.00	151.00			309.00			280.00		
20	15.6	220.00	142.00			298.00			270.00		
21	15.3	206.00	130.00			283.00			256.00		
22	14.8	183.00	109.00			257.00			233.00		
23	14.5	169.00	97.00			242.00			219.00		
24	14.4	164.00	92.00			236.00			214.00		
25	14.1	150.00	80.00			221.00			200.00		
26	13.9	141.00	72.00			211.00			191.00		
27	13.6	127.00	59.00			195.00			177.00		
28	13.4	118.00	51.00			185.00			168.00	156.00	
29	13.1	104.00	38.00			169.00			154.00		
30	13.0	99.00	34.00	31.00		164.00	164.00		149.00		
31	12.8	90.00	26.00			154.00			140.00		137.00
32	12.6	81.00	18.00		16.00	144.00		142.00	131.00		

a/ Fixed costs have been reduced $50.00.

APPENDIX C, TABLE 7

The Effects of Changes in Prices and Cost on Net Revenue and Maximum Amortized Values, Yield Anticipations Number 6, Late and Extra Late Varieties

Age of trees (years)	Yield per acre (tons)	Net revenue $60/ton	Net revenue $55/ton	Maximum amortized value		Net revenue $65/ton	Maximum amortized value		a/ Net revenue $60/ton	Maximum amortized value	
				3%	5%		3%	5%		3%	5%
0	0	-283.00	-283.00			-283.00			-283.00		
1	0	-216.00	-216.00			-216.00			-166.00		
2	0	-250.00	-250.00			-250.00			-196.00		
3	1.0	-227.00	-232.00			-222.00			-171.00		
4	5.5	-122.00	-150.00			- 94.00			- 62.00		
5	8.5	- 19.00	- 64.00			25.00			44.00		
6	14.0	154.00	79.00			229.00			221.00		
7	16.2	250.00	160.00			341.00			321.00		
8	17.8	314.00	211.00			418.00			390.00		
9	18.7	332.00	218.00			446.00			406.00		
10	19.2	395.00	271.00			495.00			449.00		
11	19.4	402.00	289.00			499.00			452.00		
12	19.3	392.00	295.00			488.00			442.00		
13	19.0	378.00	283.00			473.00			428.00		
14	18.6	359.00	283.00			452.00			409.00		
15	18.2	340.00	266.00			431.00			390.00		
16	17.7	318.00	249.00			407.00			368.00		
17	17.3	300.00	230.00			387.00			350.00		
18	16.8	276.00	192.00			360.00			326.00		
19	16.2	248.00	167.00			329.00			298.00		
20	15.6	220.00	142.00			298.00			274.00		
21	15.3	206.00	130.00			283.00			256.00		
22	14.8	183.00	109.00			257.00			233.00		
23	14.5	169.00	97.00			242.00			219.00		
24	14.4	164.00	92.00			236.00			214.00	205.00	
25	14.1	150.00	80.00	78.00		221.00	218.00		200.00		
26	13.9	141.00	72.00			211.00			191.00		184.00
27	13.6	127.00	59.00		54.00	195.00		194.00	177.00		
28	13.4	118.00	51.00			185.00			168.00		
29	13.1	104.00	38.00			169.00			154.00		
30	13.0	99.00	34.00			164.00			149.00		

APPENDIX C, TABLE 8

The Effects of Changes in Prices and Costs on Net Revenue and Maximum Amortized Values, Yield Anticipations Number 8, Late and Extra Late Varieties

Age of trees (years)	Yield per acre (tons)	Net revenue $60/ton	Net revenue $55/ton	Maximum amortized value		Net revenue $65/ton	Maximum amortized value		a/ Net revenue $60/ton	Maximum amortized value	
				3%	5%		3%	5%		3%	5%
0	0	-283.00	-283.00			-283.00			-283.00		
1	0	-216.00	-216.00			-216.00			-166.00		
2	0	-250.00	-250.00			-250.00			-196.00		
3	2.0	-185.00	-195.00			-175.00			-128.00		
4	6.5	- 73.00	-106.00			- 40.00			- 13.00		
5	12.0	149.00	87.00			212.00			212.00		
6	17.3	324.00	231.00			416.00			390.00		
7	19.0	407.00	300.00			514.00			478.00		
8	20.0	452.00	334.00			560.00			510.00		
9	20.5	440.00	331.00			542.00			490.00		
10	21.0	483.00	378.00			588.00			533.00		
11	21.0	476.00	371.00			581.00			526.00		
12	21.0	471.00	366.00			576.00			521.00		
13	21.0	471.00	366.00			576.00			521.00		
14	21.0	471.00	366.00			576.00			521.00		
15	20.9	466.00	362.00			571.00			516.00		
16	20.5	449.00	347.00			552.00			499.00		
17	20.1	430.00	330.00			531.00			480.00		
18	19.8	416.00	317.00			515.00			466.00		
19	19.4	398.00	301.00			495.00			448.00		
20	19.0	379.00	284.00			474.00			429.00		
21	18.6	360.00	267.00			453.00			410.00		
22	18.1	337.00	247.00			428.00			387.00		
23	17.8	323.00	234.00			412.00			373.00		
24	17.5	309.00	221.00			397.00			359.00		
25	17.1	290.00	205.00			376.00			340.00		
26	16.8	276.00	192.00			360.00			326.00		
27	16.5	262.00	180.00	178.00		345.00	337.00		312.00	311.00	
28	16.0	239.00	159.00		156.00	319.00		308.00	289.00		286.00
29	15.7	225.00	147.00			304.00			275.00		
30	15.5	216.00	138.00			293.00			266.00		

a/ Fixed costs have been reduced $50.00.